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MORPHOMETRIC STUDY OF SUPRASCAPULAR NOTCH IN WESTERN U.P POPULATION

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(MANISHA SCOTT)

List of abbreviation: -

ACJ-Acromioclavicular joint

GHJ-Glenohumeral joint

SSN- Suprascapular notch

STSL-Superior transverse scapular ligament

SNES-Supra scapular nerve entrapment syndrome

SSA- Supra scapular artery

SSn-Supra scapular nerve

%-percentage

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INTRODUCTION

1.STATEMENT OF PROBLEM: -

Many researchers have a studied adult dry human scapula morphology and morphometric in various countries. But collectively there is very limited information available about various parts of supra scapular notch for western UP population. Studied on the morphology of the supra scapular notch, both quantitative and qualitative, have helped to classify the predominance of different forms of the supra scapular notch in western UP population. Suprascapular notch entrapment is thought to be influenced by the size of the notch. The structure of the supra scapular notch differs from person to person, which affects the risk of nerve entrapment. Different varieties of this notch can be distinguished by their shape and the presence of a transverse ligament, which transforms the notch into a foramen.[6,39,90] During impingement syndrome, rotator cuff rupture, and shoulder prosthesis in total shoulder arthroplasty. Research on the supra scapular notch is indispensable for advancing our understanding of shoulder anatomy, pathology, and surgical interventions. Its clinical relevance extends to various fields, including orthopedics, radiology, sports medicine, and evolutionary biology. By elucidating the anatomical intricacies and functional implications of the supra scapular notch, researchers contribute to the development of innovative diagnostic and therapeutic strategies, ultimately improving patient care and enhancing our comprehension of human anatomy and evolution.[92,93,94] Situated near the superior border of the scapula, the supra scapular notch is an important anatomical structure that facilitates the passage of the supra scapular nerve and arteries. It provides innervation to the supraspinatus and infraspinatus muscles, among other shoulder muscles.[95] Comprehending this notch is essential for identifying, managing, and averting a range of ailments associated with shoulder discomfort and impairment. Thorough anatomical studies contribute to the development of a thorough classification system that helps surgeons identify patients who are at-risk and plan procedures.[96] This research seeks to clarify the importance of supra scapular notch research for the advancement of medical knowledge and enhancement of patient care. Comprehending the importance of researching the supra scapular notch necessitates exploring its anatomical complexities, clinical significance, and ramifications in other research domains. There are significant consequences for shoulder biomechanics, pathology, and surgical procedures related to its morphology, size, variances, and related structures. To completely understand its

clinical importance, researchers from a variety of fields, including anatomy, orthopedics, radiography, and sports medicine, must investigate its complexity.

2. IMPORTANCE OF STUDY:

Research on the suprascapular notch's morphology, both quantitative and qualitative, has aided in the categorization of the prevalence of various suprascapular notch forms. It is believed that the size of the notch affects suprascapular notch entrapment. Each has a unique suprascapular notch anatomy, which influences the possibility of nerve entrapment. Investigating the anatomical intricacies, clinical importance, and implications for other research domains are crucial studying the suprascapular notch. Shoulder morphology, size, variations, and related structures have important implications for shoulder biomechanics, pathology, and surgical operations. Researchers from a range of disciplines, including anatomy, orthopaedics, radiography, and sports medicine, must examine its intricacy in order to fully comprehend its therapeutic significance.[97]

2.1. Anatomical Variations: -

2.1(a). Understanding Variations: One important anatomical structure that the suprascapular nerve goes through is the suprascapular notch, a dip on the top border of the scapula. The motor innervation of the supraspinatus and infraspinatus muscles, which are critical for shoulder stability and movement, is provided by this nerve. Variations in the suprascapular notch's anatomical shape, size, and arrangement can have a major impact on the risk of suprascapular nerve entrapment, which can result in diseases such suprascapular neuropathy. Thorough investigations of these anatomical differences are essential for multiple reasons. First off, knowing the spectrum of notch variations aids in the precise diagnosis of nerve entrapment problems by clinicians. Variations include a suprascapular foramen, which is a totally ossified notch, as well as a wide, narrow, or deep notch. These may all have varying effects on the nerve, possibly leading to discomfort or compression.

For example, a deep or narrow notch has a higher likelihood of compressing the suprascapular nerve, particularly when the shoulder is moved, which can result in pain, weakness, and impaired shoulder function. By identifying these changes via diagnostic imaging, including CT or MRI scans, medical experts can pinpoint the precise anatomical characteristics causing a patient's symptoms.[75]

Furthermore, a thorough understanding of these variances is necessary for efficient treatment. Treatment plans, whether conservative or surgical, can be customized according to the suprascapular notch's unique anatomical structure. When surgery is

necessary to decompress the nerve, an accurate understanding of the anatomy of the notch aids in the planning and execution of the technique, reducing the possibility of problems and improving results. Accurate diagnosis and successful treatment of disorders associated with suprascapular nerve entrapment depend on a thorough examination of the anatomical variations of the suprascapular notch. This information helps to improve patient care and results by helping to not only pinpoint the underlying causes of symptoms but also to provide focused, efficient therapy strategies.[76]

2.1(b)classification system: One important scapular anatomical component that varies greatly in form and shape is the suprascapular notch, which affects the possibility of suprascapular nerve entrapment. Researchers have created a number of classification systems to address these differences and enhance clinical practice. The Rengachary classification, which categorizes the suprascapular notch into six types—from a wide and shallow notch (Type I) to a totally ossified notch that forms a foramen—is one of the most extensively used systems.[6]

Importance of The Classifications

standardizing descriptions: offering a framework that is uniform for characterizing the differences in the suprascapular notch.

Promoting Communication: Ensuring that medical practitioners are able to appropriately communicate and evaluate results concerning the suprascapular notch.

Relevance from a Clinical Perspective: This helps identify and treat suprascapular nerve entrapment by linking particular notch types to the possibility of nerve compression.

Research and Education: Improving the capacity to contrast and compare results from various studies and populations, so advancing our knowledge of the anatomy of the shoulder and its therapeutic consequences.

These classification systems can help researchers and doctors treat patients with disorders related to the suprascapular notch more effectively, make more accurate diagnoses, and achieve better surgical outcomes.[98]

2.1.(c)Effects on Medical Education: Anatomical variety knowledge is fundamental to medical education and is essential to the development of skilled and flexible healthcare providers. Knowing these variances guarantees that medical professionals and students are ready to identify and handle the wide range of differences they may come across in patients. This information is essential for a number of reasons.

First of all, it promotes a thorough comprehension of human anatomy that goes beyond the "norm" found in textbooks. Real-world anatomy frequently differs from textbook portrayals, and understanding these differences enables medical professionals to identify illnesses more precisely. Variations in vascular anatomy, for example, can affect how traumatic injuries are managed and how surgery is planned.

Second, knowing anatomical variances improves one's capacity to carry out clinical procedures in a secure and efficient manner. For example, being aware of potential variations in neural routes can assist avoid unintentional nerve injury during procedures or injections. Furthermore, it facilitates the precise interpretation of diagnostic imaging, as fluctuations in it can occasionally resemble diseased states.

Moreover, this comprehension equips medical practitioners to tailor medical treatment. Since each patient is different, customized treatment plans that take into account each patient's unique anatomy are made possible by the recognition of anatomical variations. In disciplines like radiography, surgery, and physical therapy, this is especially crucial.

Fundamentally, teaching anatomical variations in medical school gives aspiring medical professionals the information and abilities they need to handle a variety of clinical situations with assurance and competence, which eventually improves patient care and results.[1,99]

2.2. Clinical Significance: -

2.2(a). Suprascapular Nerve Entrapment: A crucial anatomical feature on the higher border of the scapula is the suprascapular notch. Suprascapular nerve entrapment, which happens when the nerve traveling through the notch is crushed or pinched, frequently happens at this notch. Suprascapular neuropathy is a disorder that can result from this entrapment. [100,101]

The symptoms of suprascapular neuropathy include shoulder pain and weakness, which can seriously lower a patient's quality of life. Suprascapular neuropathy often causes severe, agonizing pain that is localized to the lateral and posterior regions of the shoulder. Shoulder movements, especially those involving overhead tasks, might aggravate this pain and make it more persistent. The supraspinatus and infraspinatus muscles, which are in charge of shoulder abduction and external rotation, respectively, are the main muscles affected by the muscle weakening. Patients may thus find it difficult to lift their arms, carry out reaching or lifting chores, or participate in physical activities like sports.

A variety of factors, such as trauma, repetitive shoulder movements, thickening of the superior transverse scapular ligament, and anatomical differences in the size and

shape of the suprascapular notch, can result in suprascapular nerve entrapment." The chance of nerve compression may rise due to anatomical differences such as a deep or narrow notch. This illness can also arise as a result of repetitive overhead activities, which are frequently observed in athletes or people in particular professions.[6,7,100]

It's critical to diagnose suprascapular neuropathy early in order to stop symptoms from getting worse and to start treatment plans that work. A combination of clinical examination, imaging examinations (MRI, ultrasound, etc.), and electrodiagnostic testing is usually used to make a diagnosis. Options for treatment range from conservative measures including physical therapy, rest, and anti-inflammatory drugs to surgical procedures meant to decompress the nerve.

Pain relief, shoulder function restoration, and the ability to resume regular activities are all made possible by successful care of suprascapular neuropathy, which can greatly enhance a patient's quality of life. For healthcare practitioners to accurately diagnose and treat patients, they must have a thorough understanding of the anatomical and pathological features of the suprascapular notch and nerve entrapment.

2.2(b). Diagnostic Imaging: Interpreting diagnostic imaging, including CT and MRI scans, requires a thorough understanding of the suprascapular notch's anatomy. Understanding this anatomical feature in detail enables medical personnel to recognize changes and abnormalities that may be associated with disorders such as bone fractures or entrapment of nerves. For example, MRI can show details about soft tissues and nerve impingements, whereas CT scans can show detailed images of bone structures and help identify any fractures or ossifications inside the notch**.** When suprascapular neuropathy is present, nerve compression at the notch can cause shoulder pain and weakening in the muscles. Determining the exact cause of this condition requires accurate interpretation of these images. Enhancing patient outcomes and guaranteeing targeted treatment, it also helps plan suitable procedures, whether surgical or conservative. Fundamental to accurately diagnosing and treating associated shoulder disorders is the ability to identify the anatomy of the suprascapular notch on diagnostic images**.**[106,107]

2.2(c). Early detection and prevention: To detect and prevent suprascapular neuropathy early, a complete understanding of the anatomy of the suprascapular notch is necessary. Knowing this makes it possible for medical experts to identify anatomical differences that could put people at risk for nerve entrapment. Through physical examination and diagnostic imaging, such as MRI or CT scans, these variances can be identified, allowing clinicians to discover possible concerns before they become problematic symptoms.

Timely management is essential to halting the course of symptoms when nerve entrapment is detected early. To relieve nerve compression and stop more injury, conservative treatments such as physical therapy, activity moderation, and anti-inflammatory drugs might be used. Early surgical intervention to alleviate the compression and restore normal nerve function may be considered in cases where anatomical abnormalities, such as a narrow suprascapular notch, significantly contribute to nerve entrapment.

Preventive actions can also be extremely important, such as teaching patients how to strengthen their shoulder muscles and refrain from doing repetitive overhead motions. Healthcare professionals can dramatically improve patient outcomes by minimizing pain and functional impairment associated with suprascapular neuropathy by addressing possible issues early and using preventive methods. Ultimately, successful prevention, early detection, and therapy of this crippling illness depend on a thorough understanding of the anatomy of the suprascapular notch.[108,109]

2.3. Implications in Surgical Procedures: -

2.3(a). Surgical Planning: Surgical planning for orthopaedic and neurosurgeons requires a thorough understanding of the suprascapular notch. This knowledge is essential to prevent the suprascapular nerve from being unintentionally injured during shoulder surgeries. Due to its close proximity to the nerve, the suprascapular notch is considered a high-risk surgical site where even little surgical errors can result in serious problems, such as damage to the nerve, which can cause shoulder pain, paralysis, and reduced function.

Surgeons can precisely avoid this crucial area by being fully aware of the anatomical variances and precise position of the suprascapular notch. By using this information, surgical technique, incision location, and required dissection amount can all be optimized to preserve the nerve during the process. Careful planning reduces the possibility of nerve damage and improves surgical results overall, allowing patients to recover more quickly and have more long-term functionality.

2.3(b) Minimally Invasive Techniques: The way orthopaedic and neurosurgery treatments are carried out has completely changed as a result of advancements in less invasive surgical techniques like arthroscopic surgery. These methods use fewer incisions and specialized devices with the goal of minimizing tissue damage, shortening recovery periods, and improving patient results. But their effectiveness depends on accurate anatomy, especially in locations with intricate features like the suprascapular notch.

A crucial location for shoulder procedures is the suprascapular notch, which is where the suprascapular nerve passes. Doing minimally invasive treatments in this area safely requires a detailed grasp of its anatomy, including differences in notch shape, size, and the presence of any ossification. Suprascapular notch studies provide important information that improves these surgical methods by precisely identifying and avoiding important structures. Knowing this reduces the possibility of unintentional nerve damage, helps organize the surgical strategy, and positions instruments accurately.

Through the incorporation of comprehensive anatomical research into the creation of minimally invasive procedures, physicians may optimize the accuracy of their operations, resulting in better patient outcomes, lower rates of complications, and quicker recuperation periods. The constant improvement and modification of surgical techniques highlights how crucial anatomical research is to the advancement of medical knowledge.[111,112,113]

2.3(c). Post-Surgical Outcomes: When it comes to shoulder procedures in particular, it is essential to comprehend the architecture and variations of the suprascapular notch in order to predict and enhance post-operative outcomes. Shape, size, and ossification presence can vary greatly in the suprascapular notch, which contains the suprascapular nerve. The efficacy of the procedure and the likelihood of complications can be affected by these variances in surgical planning and execution.

For example, a surgeon can adjust their surgical technique to prevent damage to the suprascapular nerve if they are aware of the unique anatomic variation of a patient, such as a thin or deep suprascapular notch. By being mindful of the potential for unintentional nerve compression or injury, post-surgical problems such as prolonged pain or functional impairment can be prevented.

Furthermore, having a thorough understanding of the suprascapular notch enables surgeons to foresee and resolve any complications that may arise, protecting vital structures and enhancing surgical result. Based on the patient's anatomical traits, this knowledge can also help healthcare personnel anticipate and manage certain hazards, which can inform postoperative rehabilitation techniques.

Overall, accurate understanding of the anatomy of the suprascapular notch improves surgical precision, aids in a better recovery following surgery, and improves patient outcomes in general for shoulder procedures and scapula-related diseases.[114,115]

2.4. Research in Pathology and Biomechanics:

2.4(a). Pathological Conditions: Studies on the suprascapular notch have been conducted on a range of pathological diseases, including as fractures, cysts, and bone cancers. Important information on how these disorders impact the notch and adjacent structures is provided by in-depth anatomical research. Bone tumours have the ability to change the shape of the suprascapular notch, which may compress the suprascapular nerve that passes through this area. The shoulder region may experience pain, atrophy, and weakening as a result of this nerve compression, which will have a major effect on arm function.[103(a)]

Similar symptoms can also be brought on by cysts, which can form inside or close to the suprascapular notch and push on the suprascapular nerve. Comprehending the precise anatomic connection between cysts and the notch is crucial for precise diagnosis and efficacious therapy, which may encompass surgical excision of the cyst.[103(b)]

The typical bone and ligamentous structures may be disrupted by fractures involving the suprascapular notch, which may cause nerve injury or entrapment. In order to determine the extent of the injury and to plan surgical procedures intended to restore normal anatomy and function, a thorough understanding of anatomy is required.

By addressing the underlying anatomical problems, this research will help medical personnel detect and treat illnesses that impact the suprascapular notch more accurately, ultimately leading to better patient outcomes.

2.4(b). Biomechanical Studies: One important anatomical feature that is being studied in biomechanical studies on the shoulder joint is the suprascapular notch. Because the suprascapular nerve and arteries flow through it, they are essential for the stability and mobility of the shoulder, which makes the notch an important part of shoulder mechanics. Enhancing treatment approaches is made easier by knowing how the suprascapular notch functions and how it affects the biomechanics of the shoulder joint. This information is crucial for managing shoulder injuries and developing efficient rehabilitation plans, which will eventually improve patient outcomes and recuperation.[100,104]

2.4(c). Evolutionary Biology: Evolutionary biologists can compare the morphology of different species by studying the suprascapular notch, which has important significance for the field. Researchers can learn more about the evolutionary adaptations of the shoulder girdle by analysing the similarities and differences in the suprascapular notch. With the aid of comparison, it is possible to comprehend how many species have developed unique shoulder mechanics to meet their own functional requirements, including those related to feeding, moving, and other activities. These discoveries advance knowledge of the evolution of the musculoskeletal system and its development.[102]

3. ANATOMY OF SCAPULA: -

The dorsolateral side of the thorax contains the triangular, flat scapula bone. It exchanges information with the acromioclavicular joint (ACJ) via the clavicle and the shoulder through the glenohumeral joint (GHJ). Muscle attachments to the thorax, base of the head, and vertebral column hold it in place. Because of the chest's barrel-shaped shape, it has an elevated back surface and a bent front surface. The superior border, the lateral border, and the medial or vertebral border are its three boundaries. There are two bone projections: the acromion's spine and coracoid. (Fig 3.1).

The concave anterior surface Is called the subscapular fossa. Its concavities are medio-lateral and supero-inferior. The upper third of the inner edge, which coincides with the third rib, is primarily responsible for the primary curve. Despite the thin and weak nature of the bone, the outside curving edge functions as a strong support, keeping the bone from bending under intense muscular pressures. It has several borders that mark the beginning of the subscapularis muscle's musculotendinous units. The large tendon of the subscapularis muscle enters the humerus's smaller tuberosity just below the coracoid process. The entire medial edge of the vertebrae on the ventral surface provides attachment to the serratus anterior muscle.[1,83]

The scapular spine separates the convex dorsal side of the scapula into two fossae, one supraspinous and one infraspinous, as seen in the image(fig.1). Situated just inside the scapular neck, they are joined at the spinoglenoid notch. The muscle known as the supraspinatus fills the supraspinous fossa, which takes its shape from the shape of the muscle. The suprascapular nerve (SSN) and artery (SSA) enter the super spinous fossa through the supress scapular notch (SSN), which is located posterior to the base of the coracoid, via a little fibrosseous tunnel. The supraspinatus muscle creates a slender tendon that enters the greater tuberosity of the humerus after passing beneath the acromion arch. Numerous accounts have been offered of this notch's anatomy. The suprascapular artery provides the majority of the blood supply to the scapula. It goes via a tiny aperture on the side of the supraspinous fossa to penetrate the bone.[105]

The infraspinatus muscle is under the control of the suprascapular nerve, which also governs the action of the supraspinatus muscle through its infraglenoid branch. Additionally, it possesses sensory branches that give the shoulder joint sensation.

The infraspinous fossa is the bigger of the two dorsal fossae. The infraspinous muscle begins at the majority of its arched surface[118]. The teres minor muscle is situated on the lateral margin of the scapula. These two muscles support wide

ligaments that contribute to the humeral head's more pronounced tuberosity. From the glenoid to the inferior angle of the scapula, dense cortical bone forms the lateral border of the scapula. This marks the location where the glenoid meets the outer edge or border and is formed where the long head of the triceps muscle attaches.

The thoracic vertebrae 2 through 7 and the medial margin of the scapula are next to one another. The segments that are inferior and superior are both shorter. The two segments come together at the medial angle. At the junction of the medial angle and the scapula's spine, the rhomboid minor attachment forms a triangle ridge. This is the easily perceptible medial border of the most prominent area of the scapula. There are a few strong anatomical connections at the average boundary, such as muscles emanating from the spinal column, the base of the brain, and the chest. These muscles aid in the raising and lowering the shoulder blade.

Of the three, the scapula's superior border is the shortest and sharpest. Ending at the posterior border of the suprascapular notch, it descends laterally toward the base of the coracoid process. It is entirely covered by the muscles. The scapula's superior angle Further caudally from the boundary arise the teres minor, teres major, and a section of the latissimus dorsi muscles. The point where the lateral and medial borders of the scapula meet most caudally is where the inferior angle is formed. This prominent area of the scapula is easily palpable. The circumflex scapular artery forms a groove on the lateral border of the scapula as it travels from the anterior to the posterior of the scapula. Usually, this can be located midway along the horizontal limit.[110]

Is created at the Intersection of superior and medial borders. This is entirely covered by and imperceptible to the naked eye due to the trapezius muscle.

The supraspinous and infraspinous fossae are divided by the scapular spine, which is situated between the top and bottom halves of the scapula. Forming the backbone of the scapula, it is composed of robust cortico-cancellous bone and stretches from the inner edge of the scapula to the glenoid neck. It emphasizes the wide, weak bone's trustworthiness, much like that of a boat. It also acts as an attachment point for the deltoid and trapezius muscles, helping to suspend the scapula.

The lateral pre-extension of the spine is called the acromial process. Anecdotally, the Greek word for "top" is "across," which explains why it is called the top of the shoulder. It is a quadrilateral construction with the Angular Acromial is, a prominent angle, on the posterior surface.[117]The acromion is layered across the rotator cuff muscle and the humeral head. It is attached to the coracoid location by the strong coracoacromial ligaments. An arch is formed by this network of bones and ligaments above the rotator cuff and humeral head.

Starting at the glenoid's supero-average surface, the coracoid interaction takes place. The coracoid root is defined medially by the suprascapular notch and laterally by the tiny tubercle known as the supraglenoid tubercle. To become almost equal, the coracoid twists vigorously at the coracoid tubercle after passing upward from its base. At the distal tip, the body inserts the pectoralis minor and the coracobrachialis muscles (a conjoint tendon) of the short head of the biceps. Because of the forces these muscles apply, the rough superior surface of the coracoid helps to hang the scapula from the clavicle. It is attached to the clavicle by powerful ligaments called the conoid and trapezoid ligaments.[116]

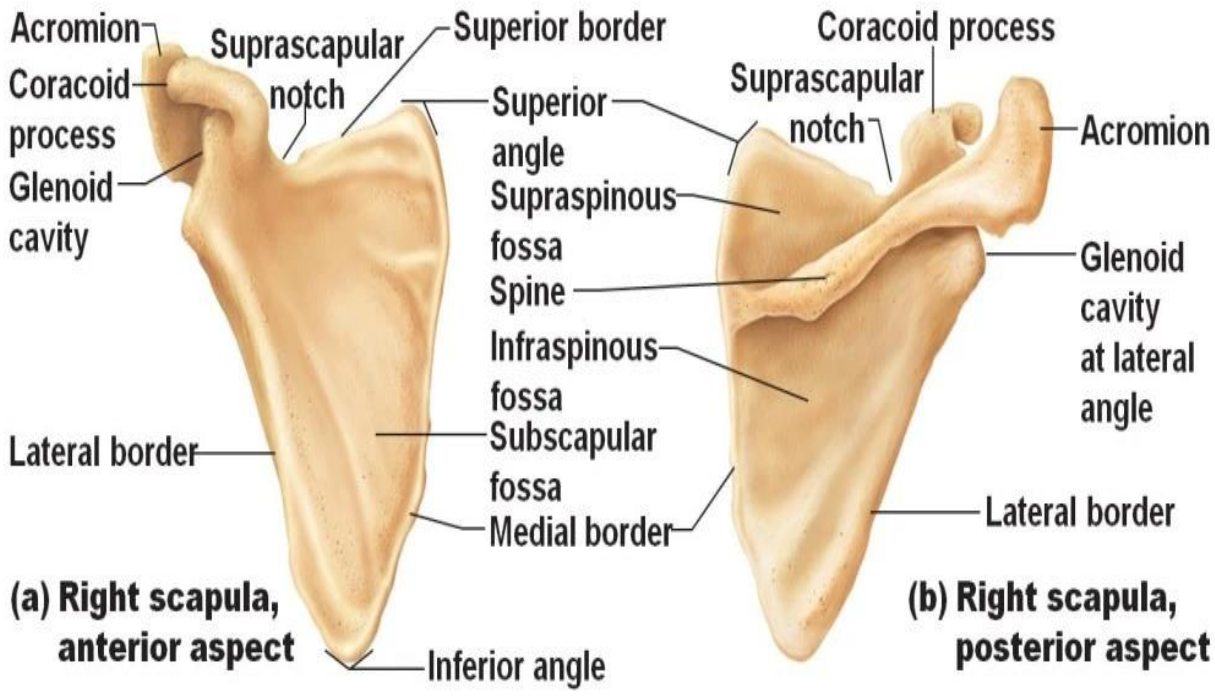


Figure 3.1: showing anterior and posterior view of scapula.

4. THE SUPRASCAPULAR NOTCH: -

The scapula, or shoulder blade, is a flat, triangular bone found on the upper back, between the second and seventh ribs. A small groove, known as the suprascapular notch, is located near the base of the coracoid process at the outer end of the top border. This groove is turned into a small opening by a ligament called the superior transverse scapular ligament, which allows the suprascapular nerve to pass through[1](Fig 4.1). The supra scapular notch has drawn a lot of interest from medical professionals and researchers because of its function in disorders and operations involving the shoulder.

In 1959, Kopell and Thompson published the first description of suprascapular nerve entrapment syndrome. They found that the likelihood of the nerve becoming trapped increased with the size of the suprascapular notch.[2a] They claimed that the suprascapular nerve was pulled in one direction or the other by the abduction or horizontal adduction of the shoulder, causing it to compress against the superior transverse scapular ligament. The many anatomical variations of the suprascapular notch are one of the common reasons of entrapment of the suprascapular nerve. These variances include changes in the notch's form and partial or total ossification (hardening) of the superior transverse scapular ligament. Based on factors including the notch's vertical length, transverse diameter, and form, different workers in diverse demographics have classified SSNs.[4,6] Typically, this condition is characterized by a dull, throbbing discomfort in the side and back of the shoulder, atrophy of the infraspinatus and supraspinatus muscles, and weakness in the ability to lift the arm away from the body (abduction) and move it outward (external rotation).[69,70,71,72,73,74]

The supra scapular notch, forms a bony archway through the supra scapular nerve passes, is situated where the scapular notch and the superior transverse scapular ligament converge. This nerve, which supplies motor activity to the supraspinatus muscle, emerges from the upper trunk of the brachial plexus and passes through the notch. It continues on after that, contributing to the innervation of the infraspinatus muscle. [2b]

Suprascapular nerve entrapment syndrome is one of many shoulder problems that can result from compression or entrapment of the supra scapular nerve in the supra scapular notch. Applying pressure to the region surrounding the shoulder blade's suprascapular notch may cause the pain.[8] The damaged shoulder may experience pain, weakness, and muscle atrophy as a result. As smaller or shallower notches are linked to a higher risk of nerve compression, anatomical changes in the size and shape of the supra scapular notch have been thoroughly examined in relation to these

illnesses. Numerous investigations of the various configurations of the suprascapular notch throughout the years have concluded that one potential cause of suprascapular neuropathy is an ossified, or hardened, suprascapular ligament. [3]

For accurate diagnosis and successful treatment of shoulder disorders, it's essential to comprehend the anatomy and variations of the supra scapular notch. In particular, by releasing or eliminating the superior transverse scapular ligament, surgical interventions, including decompression techniques, may be used to relieve the compression of the supra scapular nerve.[1]

Orthopaedic physicians can better understand suprascapular nerve entrapment syndrome by examining the dimensions and form of the suprascapular notch.[4]Healthcare specialists hope to advance their understanding of shoulder problems and improve patient care by delving into the subtleties of the supra scapular notch.

Since a narrow notch is frequently present in patients with suprascapular nerve entrapment, the size and form of the suprascapular notch may be important in this condition. [10]

Figure 4.1:-shwoing suprascapular notch

5.STRUCTURE PASSES THROUGH THE SUPRA SCAPULAR NOTCH: -

The notch at the superior edge of the scapula is called the Suprascapular notch. Its composition consists of:

1.The ligament known as the superior transverse scapular ligament transforms the supra scapular notch into a foramen by bridging it.

2.Scapular superior and inferior borders: The supra scapular notch is located in between the scapular superior and inferior borders.

The supra scapular notch, through which the supra scapular nerve and artery passes, is defined by these components collectively.

5.1. Supra scapular artery: One important blood vessel that supports the shoulder region's circulatory supply is the supra scapular artery (Fig 5.4). It starts as a branch of the subclavian artery called the thyrocervical trunk and proceeds laterally in the direction of the superior border of the scapula. As it travels through the supra scapular notch and above the transverse scapular ligament. The supraspinatus and infraspinatus muscles, the acromio clavicular joint, and the surrounding ligaments are among the muscles and tissues in the shoulder girdle that is supplied by branches of the supra scapular artery[83,84,85]. For these structures to be nourished, maintained, and to enable tissue regeneration and repair, there must be an artery supply. In some reconstructive surgeries, surgeons may also use the supra scapular artery as a graft, taking advantage of its accessibility and closeness to the shoulder bones. Clinicians who diagnose and treat shoulder injuries and vascular problems must have a thorough understanding of the supra scapular artery's structure and function. [10]

5.2. Supra scapular nerve: The supra scapular nerve, which originates from the upper trunk of the brachial plexus and is predominantly composed of fibers from the fifth and sixth cervical nerves (C5-C6), is an essential for the innervation of the shoulder.[9] It travels across the neck's posterior triangle, crossing the transverse scapular ligament and going under the omohyoid muscle. Providing motor innervation to the supraspinatus and infraspinatus muscle. For shoulder abduction, the supraspinatus muscle is helpful, while infraspinatus muscle is for external rotation. During overhead activities and throwing motions in particular, both muscles are essential for shoulder stability and movement. The supra scapular nerve supplies sensory fibers in addition to motor functions, giving the acromio clavicular joint and the shoulder capsule sensation. Shoulder dysfunction,

discomfort, and limited range of motion can arise from injuries or compression of the supra scapular nerve, which can cause weakening or paralysis of the supraspinatus and infraspinatus muscles. Nerve compression can be caused by trauma, dislocation of the shoulder, repetitive overhead tasks, or structural abnormalities such hypertrophied transverse scapular ligament.[83,86]

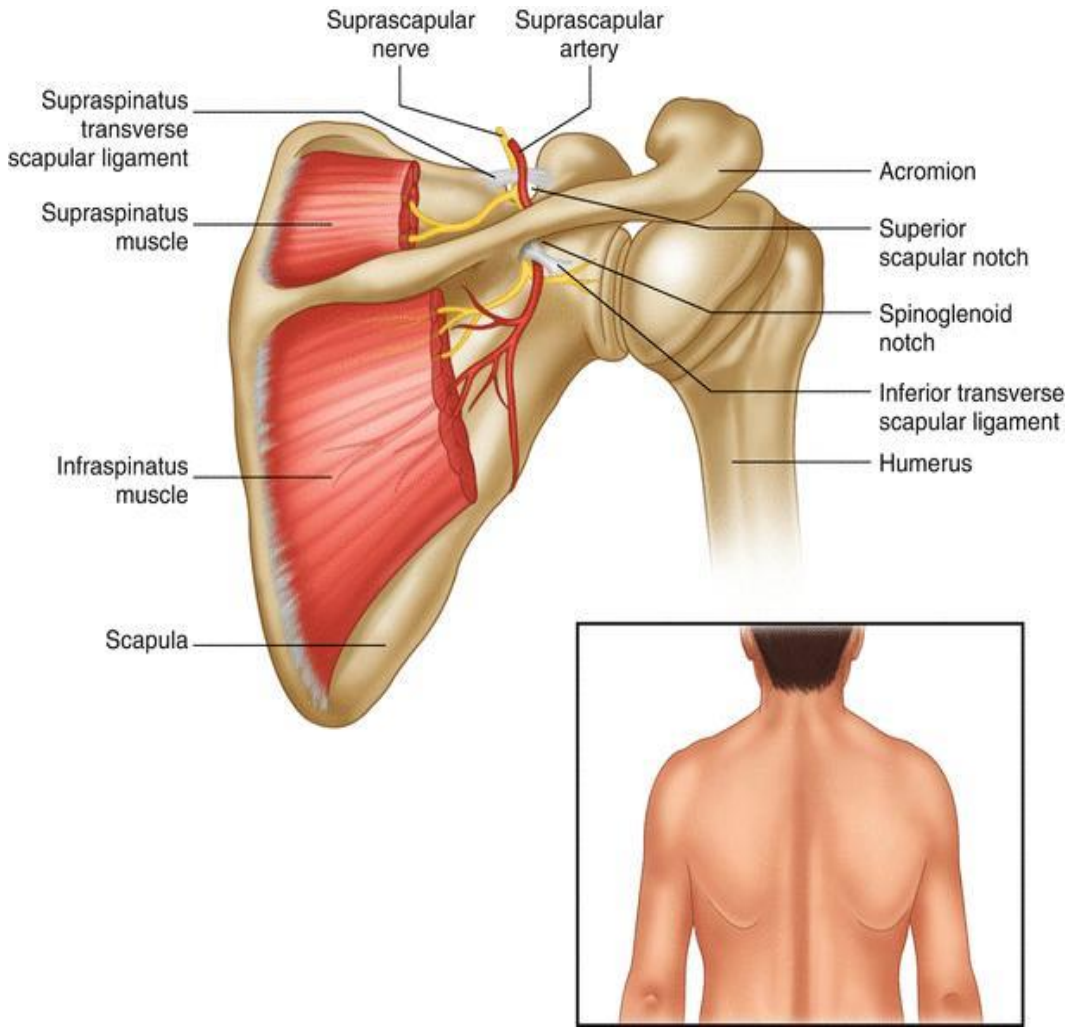


Fig 5.3: - showing structure (Suprascapular artery and nerve) passing through suprascapular notch.

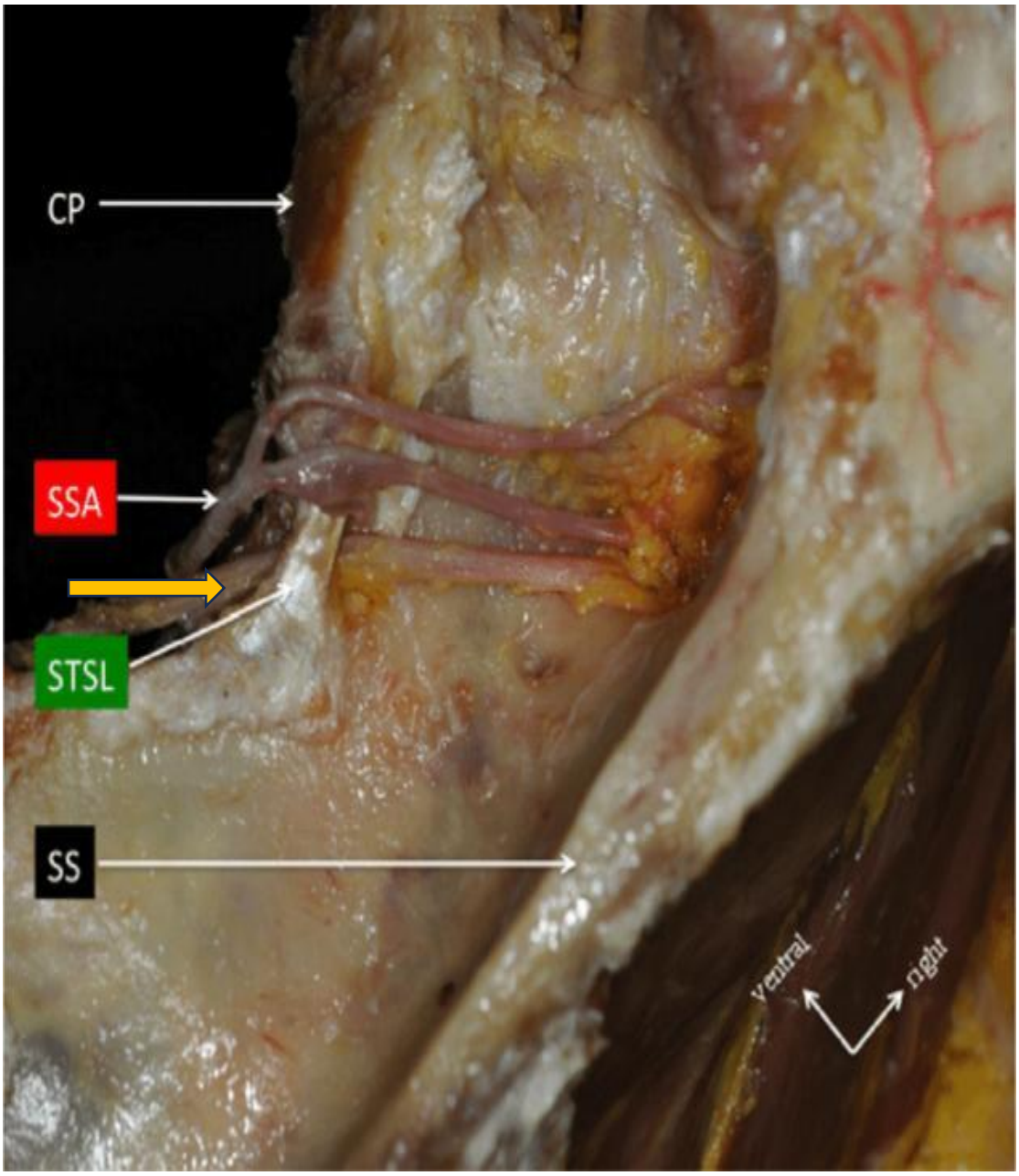


Figure 5.4. Showing structure passing through SSN.

SSA-Suprascapular Artery

STSL-Superior transverse scapular ligament

- Suprasscapular nerve

6.CLASSIFICATIONS OF SUPRASCAPULAR NOTCH:

Based on the anatomical variations of the suprascapular notch, numerous classification systems have been established by researchers. These divisions aid in comprehending the appearance and possible dangers of nerve entrapment. Polguj et al.'s comprehensive five-type system,[39]Tomažič and Šimenko's three types depending on notch shape[87] and Rengachary et al. six types,[6,7] which range from large depressions to entire bone foramina, are notable systems. Different forms and ossification patterns can be identified using the frameworks provided by each categorization, which is essential for the diagnosis and treatment of disorders affecting the suprascapular nerve.

6.1. Ticker Classification (1942): The suprascapular notch is divided into four categories according to the Ticker Classification, a simple approach that classifies anatomical shape and depth:

Type I: Shallow, Wide Notch
Features: A shallow, wide notch.
Clinical Implications: The suprascapular nerve has plenty of room thanks to the broad, less conspicuous shape, which considerably lowers the possibility of nerve entrapment. This kind is said to have a good anatomical structure and a low chance of nerve-related issues.

Type II: Moderately Deep Notch
Features: Compared to Type I, this notch is noticeably deeper and more prominent.
Clinical Implications: This type maintains a modest risk of entrapment because, despite being deeper than Type I, it still provides a good amount of space for the nerve. With a little higher risk of nerve compression, it is usually regarded as a tolerable variation.

Type III: Deep and Narrow Notch
Features: Narrow and deep notch.
Clinical Implications: This form's restricted area raises the possibility of suprascapular nerve entrapment. Because of its deep and narrow shape, there may be a higher risk of nerve compression, which could result in symptoms connected to the nerves and need for close observation and care.

Type IV: Osseous Foramen
Features: include the suprascapular ligament's complete ossification, which transforms the notch into a foramen.

Clinical Implications: Suprascapular nerve entrapment is highly likely due to the permanent hole created by the inflexible, non-flexible bone structure. It is frequently necessary to perform surgery to release the entrapment because this type is linked to the highest risk of nerve compression and consequences.[88]

6.2. Rengachary Classification (1989): One of the most well-known systems for classifying the suprascapular notch according to its anatomical differences is the Rengachary classification. There are six varieties in total, and each has unique traits and effects on the risk of nerve entrapment.

Type I: Large, U-Shaped Notch

Features: A sizable U-shaped notch that is either not at all or very slightly indented. **Clinical Implications:** This form minimizes the risk of nerve entrapment by giving the suprascapular nerve plenty of room. With a low chance of nerve-related problems, it is regarded as a desirable anatomical form.

Type II: Constricted V-Shaped Notch

Features: A V-shaped notch that is somewhat restricted but still rather wide. **Clinical Implications:** Despite considerable constriction, nerve entrapment is not as likely as with other forms. By giving the nerve a respectable amount of room, this kind lessens the chance of compression.

Type III: U-Shaped Notch

Features: The most prevalent kind is distinguished by a U-shaped notch that is both wide and relatively deep.

Clinical Implications: This morphology presents a moderate risk of entrapment while providing a balanced area for the nerve. Most people agree that it is a common anatomical variation with a controllable risk of nerve compression.

Type IV: Deep, V-Shaped Notch

Features: A V-shaped notch that is deeply set.

Clinical Implications: The smaller and deeper shape raises the possibility of nerve-related issues, including minor compression of the nerve. There is a greater chance of suprascapular nerve entrapment and associated symptoms with this variety.

Type V: Partial or Full Foramen

Features: A depression that a tiny osseous bridge transforms into a partial or full foramen.
Clinical Implications: Because of the osseous bridge's restricted area for the nerve, there is a much higher chance of nerve entrapment. There is a greater chance of nerve compression with this kind, which could result in problems with the nerves.

Type VI: Complete Ossification

Features: A foramen in the bone formed by the transverse scapular ligament fully osseous.
Clinical Implications: The severe variety has the highest risk of nerve entrapment because it surrounds the nerve with a stiff, non-flexible bone. It is the most likely to result in severe nerve compression and the symptoms that go along with it, which calls for close observation and maybe surgery.[6,7]

6.3. Natsis Classification (2007): A comprehensive system that concentrates on the skeletal characteristics and possible influence on the suprascapular nerve was presented by Natsis et al. The Natsis Classification is a thorough method that focuses on the suprascapular notch's skeletal features and possible effects on the suprascapular nerve. It was created by Natsis et al. There are five categories in the classification:

Type I: Wide and Deep Notch
Features: On the superior edge of the scapula, this kind has a deep and wide indentation.
Clinical Implications: Preventing nerve compression or entrapment, it usually provides sufficient room for the suprascapular nerve to flow through.

Type II: Wide and Shallow Notch
Features: This notch has a shallower indentation than Type I since it is wider but not as deep.
Clinical Implications: Although the nerve has enough room, its shallow structure may make it slightly more susceptible to outside stresses.

Type III: Narrow and Deep Notch
Features: This kind is distinguished by a deep indentation that is both narrow.
Clinical Implications: There is a greater chance of nerve entrapment due to the confined space, which can make the suprascapular nerve more vulnerable to compression.

Type IV: Small and Narrow Notch with Ossified Transverse Scapular Ligament Forming a Bony Foramen

Features: This variation has a bony foramen created by the ossification of the transverse scapular ligament, which is represented by a short, narrow notch.
Clinical Implications: Rigidity caused by the ossified ligament may result in nerve entrapment within the bone foramen, which may cause pain and dysfunction.

Type V: Absent Notch with a Complete Bony Bridge
Features: This kind is characterized by a continuous bony bridge in place of the notch, which is completely absent.
Clinical Implications: There is a considerable increase in the danger of compression and entrapment since the nerve must pass through a completely enclosed bone tunnel.[5]

6.4. Iqbal and Iqbal Classification (2010): Based on the form of the suprascapular notch, Iqbal and Iqbal devised a fundamental classification system. This categorization aids in comprehending the anatomical differences that may impact the suprascapular nerve. Here is a thorough explanation of every kind found in the Iqbal and Iqbal categorization.

Type I: Narrow, Broad Notch

Features: This type has a notch that is broad overall but tiny in width.
Clinical Implications: By giving the suprascapular nerve plenty of room, the broad form may lessen the chance of nerve compression or entrapment.

Type II: Intermediate Notch

Features: The shape of this notch is in between the narrow, deep type and the narrow, broad type.

Clinical Implications: Compared to the other forms, the intermediate shape provides a moderate amount of space for the nerve with a balanced risk of compression.

Type III: Narrow and Deep Notch

Features: This kind is distinguished by a notch that is deeply indented and narrow in breadth.

Clinical Implications: The suprascapular nerve may be more vulnerable to compression due to its thin and deep structure, which raises the risk of nerve entrapment and the accompanying clinical symptoms.

Type IV: Ossified Ligament Creating a Foramen

Features: The suprascapular nerve must pass through a bone foramen formed by the ossification of the transverse scapular ligament.

Clinical Implications: Rigid bone formation caused by the ossified ligament greatly raises the possibility of nerve compression and entrapment. This may result in clinical disorders that cause discomfort and dysfunction in the shoulder area, such as suprascapular nerve entrapment syndrome.[89]

6.5. Polguj Classification (2011): A classification scheme for the suprascapular notch was presented by Polguj et al. on the basis of the structure's form and the existence of ossified features. Understanding anatomical changes and their possible effects on the suprascapular nerve is aided by this classification. This is a thorough explanation of every kind in the Polguj classification.

Type I: U-shaped Notch without Ossification Features:

Features: This variety has a U-shaped notch without any signs of ossification, with rounded, smooth outlines.

Clinical Implications: By giving the suprascapular nerve enough room, the U-shaped notch reduces the possibility of nerve compression.

Type II: V-shaped Notch without Ossification

Features: This notch is free of ossification and is V-shaped, with a more acute angle than the U-shaped notch.

Clinical Implications: There may be a higher chance of nerve entrapment in the V-shaped notch due to its possible lack of nerve space compared to the U-shaped notch.

Type III: Partially Ossified J-shaped Notch

Features: A partial ossification-accompanied J-shaped notch is the defining characteristic of this kind. Within the notch, the ossified segment may create a partial bony structure.

Clinical Implications: A more rigid environment caused by partial ossification may make the nerve more vulnerable to compression or entrapment within the notch.

Type IV: Completely Ossified Notch Forming a Foramen

Features: The suprascapular nerve must pass via a foramen formed by a fully osseous notch that is fully ossified**.**

Clinical Implications: The totally osseous notch considerably raises the danger of nerve compression and entrapment by providing a fixed, limited channel for the nerve. Clinical signs include discomfort, weakness, and dysfunction in the shoulder area may result from this.[37,39]

6.6. Soni et al. Classification (2012): Based on the morphology of the suprascapular notch and the possibility of nerve entrapment, Soni et al. suggested a classification system for it. This classification aids in determining the probability of clinical conditions connected to suprascapular nerve entrapment. Each kind in the Soni et al. taxonomy is described in full below:

Type I: Broad Notch with Low Danger

Features: The notch on this type is wide and broad

Clinical Implications: The broad notch is a low-risk version because it provides enough space and lowers the danger of suprascapular nerve compression or entrapment.

Type II: Moderately Risky Narrow Notch

Features: This notch is not the narrowest, but it is narrower than Type1.

Clinical Implications: This variety of nerve entrapment is somewhat hazardous due to the increased chance for nerve compression caused by the tighter gap.

Type III: Complete Ossification of Foramen with High Danger

Features: A bony foramen is formed when the transverse scapular ligament is fully osseous.

Clinical Implications: The suprascapular nerve must pass through a stiff bony structure created by full ossification, which greatly increases the risk of nerve compression and entrapment. It is therefore a variant with a significant risk.

Type IV: Low-Risk, Wide, Shallow Notch

Features: This kind is distinguished by a shallow, broad notch.

Clinical Implications: The nerve has enough room due to the large opening and shallow nature, reducing the possibility of compression. This variant is thought to pose little risk.

Type V: Deep, Narrow Notch with More Danger

Features: The notch is thin and deep in this form.

Clinical Implications: Compared to other varieties, this one is more harmful due to its combination of narrowness and depth, which raises the risk of nerve entrapment. The confined area may cause severe compression of the nerves.[39,90]

6.7. Vathana et al. Classification (2019): A straightforward classification scheme for the suprascapular notch was put forth by Vathana et al. and was based on the notch's degree of development as well as its presence or absence. This classification helps discover changes that could affect the suprascapular nerve rapidly. The following provides a thorough explanation of every kind in the Vathana et al. classification:

Type I: A Distinct Notch is Present

Features: On the superior edge of the scapula, this form is distinguished by a well-developed and well-defined suprascapular notch.

Clinical Implications: The likelihood of nerve compression or entrapment is decreased when there is a clear notch that allows sufficient space for the suprascapular nerve to pass through.

Type II: Partially Developed Notch

Features: This kind has a partially developed notch, which means it might not be as deep or clearly defined as a definite notch.

Clinical Implications: Differences in the amount of space available for the suprascapular nerve may result from the partial development of the notch. There may be a moderate risk of nerve compression or entrapment, depending on the level of development.

Type III: Notch is Absent

Features: This kind has a continuous superior edge of the scapula without any indentation since the suprascapular notch is completely absent.

Clinical Implications: Because the suprascapular nerve must travel through a narrower opening, the lack of a notch might greatly raise the risk of nerve compression. This may result in the development of clinical signs of nerve entrapment, including shoulder discomfort and dysfunction.[25,39,91]

6.8. Tomažič and Šimenko Classification (2021): Tomažič and Šimenko suggested categorizing the suprascapular notch according to its depth and form. The suprascapular nerve may be affected by anatomical variations that can be identified with the aid of this classification. The following provides a thorough explanation of every kind in the Tomažič and Šimenko classification:

Type I: Circular, Deep Notch

Features: The superior edge of the scapula has a deep, round notch that distinguishes this kind.

Clinical Implications: By giving the suprascapular nerve, a distinct and well-defined path, the deep, round shape may lessen the chance of nerve compression or entrapment. However, depending on the overall size and available area, the depth of the notch may still be dangerous.

Type II: Tiny Notch with a U Shape

Features: This kind has a tiny notch that forms a U. The U form denotes a more expansive aperture with more rounded corners.

Clinical Implications: There is a greater chance of nerve compression because the little U-shaped notch may not give the suprascapular nerve as much room as a larger notch. There may be some defence against jagged compression points provided by the rounded edges.

Type III: Tiny Notch with a V Shape

Features: This kind is distinguished by a tiny, V-shaped notch. The V shape denotes a sharper edge and a more acute angle.

Clinical Implications: Of the three forms, the little V-shaped notch gives the least amount of room for the suprascapular nerve. The V shape's abrupt, acute angle may raise the possibility of nerve compression and entrapment, which could result in clinical symptoms such shoulder pain and dysfunction.[87]

7.TYPES OF SUPRASCAPULAR NOTCH: -

The Ranga-Chary classification system is a way of classifying the supra scapular notch's morphology that was first presented by Ranga-Chary et al. in 1989. [5,6] The suprascapular nerve and vessels can pass through the suprascapular notch, which is situated at the superior border of the scapula. Diagnosing suprascapular nerve entrapment syndrome—a condition marked by pain and muscular weakness brought on by nerve compression—requires an understanding of its anatomical variations. It is also necessary to have precise understanding of the notch's anatomy in order to undertake shoulder procedures, guarantee efficient nerve decompression, and prevent iatrogenic complications. Classifications such as the Ticker and Rengachary systems aid in the assessment of these variances, leading to improved surgical and clinical results.

Based on its anatomy, the supra scapular notch is classified into six categories by the Ranga-Chary categorization system.

Several varieties of suprascapular notch can be distinguished by their respective shapes:

Type I: There is no notch at all.
Type II: V-shaped notch, broad and blunted.
Type III: U-shaped notch that is symmetrical and has parallel sides.
Small V-shaped notch (Type IV).
Type V: A partially hardened (ossified) material.
Ligament that has entirely stiffened, or ossified (type VI).[79](Fig 7.1).

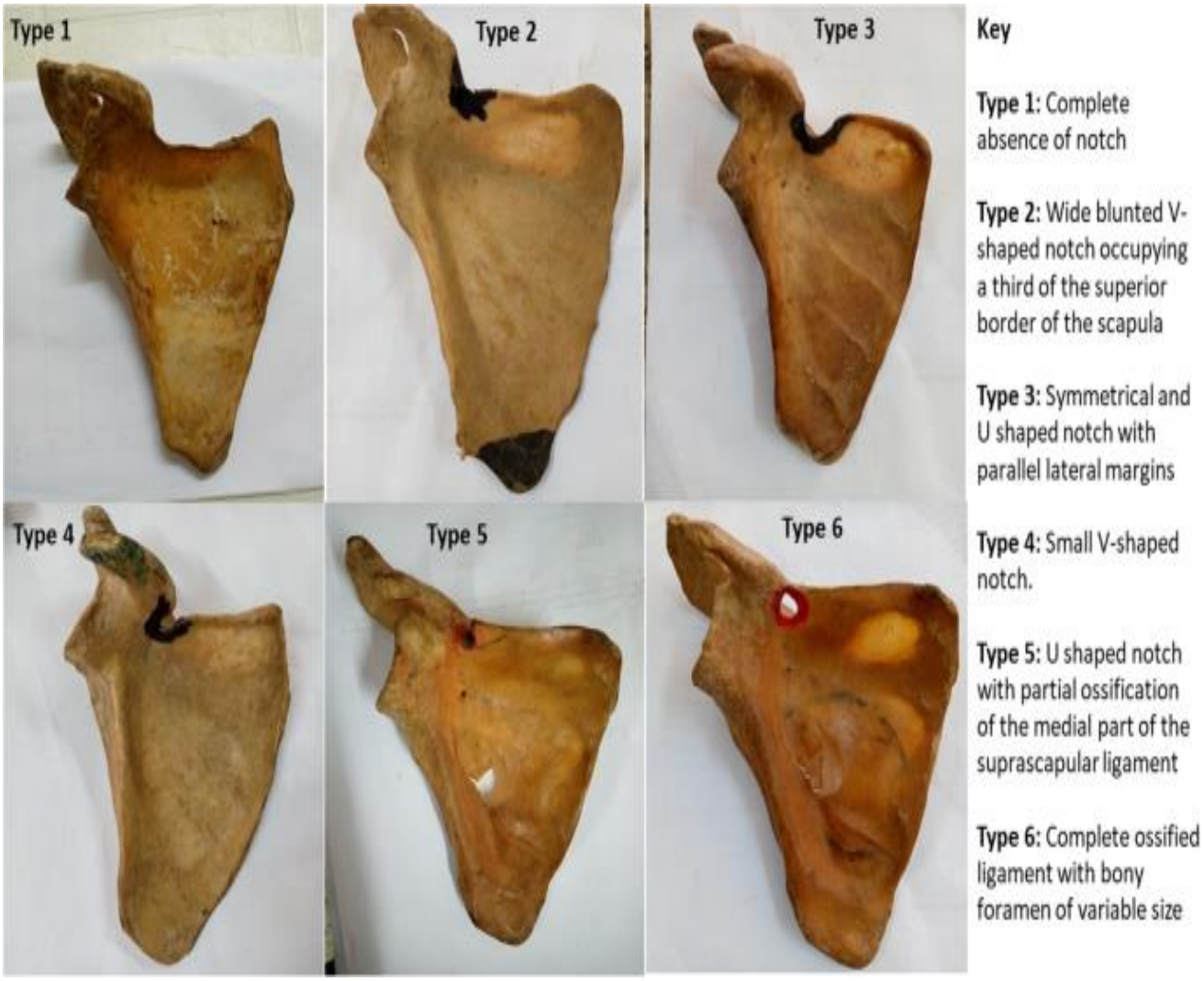

Type 1
Type 2
Type 3
Type 4
Type 5
Type 6
Key
Type 1: Complete absence of notch
Type 2: Wide blunted V-shaped notch occupying a third of the superior border of the scapula
Type 3: Symmetrical and U shaped notch with parallel lateral margins
Type 4: Small V-shaped notch.
Type 5: U shaped notch with partial ossification of the medial part of the suprascapular ligament
Type 6: Complete ossified ligament with bony foramen of variable size

Fig 7.1: - Showing various types of SSN

AIM

To conduct a comprehensive morphometric analysis of the suprascapular notch in the Western UP population, aiming to contribute to the understanding of anatomical variations and potential clinical implications.

OBJECTIVES

1.Determine the anatomical variations of the suprascapular notch in the Western UP population.

2.Quantify the morphometric parameters including dimensions and shapes of the suprascapular notch.

3.Assess potential clinical implications of observed morphometric variations, particularly in relation to suprascapular nerve entrapment syndrome.

8.Review of literature

Sushmita Saha et al.2020, Studied two hundred and ninety adult dry scapula (132 right and 158 left) among North India population. With a frequency of 41.7%, Type III suprascapular notch was the most common of the various varieties. The ossified superior transverse scapular ligament (STSL), which can have a band-like or fan-like shape, was also shown to vary. A thorough measurement revealed that 42.2% resembled bands and 57.5% resembled fans. The fully ossified STSL measured an average of 7.49 mm in length, 3.43 mm in width, and 2.8 mm in thickness. The average length and width of the entire suprascapular foramen were 7.36 mm and 4.39 mm, respectively.[16]

Ishwar B. Bagoji et al.2020, Analyzed a total of 138 try human scapula from the unknown sex on both sides. For each supra scapular notch, four measurements were taken: maximum depth (MD), middle transverse diameter (MTD), total circumference diameter (TCD), and superior transfers diameter (STD). 29 (21.01%) of the 138 scapulae that were examined had a V-shaped notch, 14 (10.4%) had a J-shaped notch, and 67 (48.55%) had a U-shaped notch. Furthermore, 9 scapulae (6.52%) had a missing notch. Two scapula (1.44%) had large double foramens. The supra scapular notch was complete in 6 scapula (4.34%) the notch was absent from 7 (5.07%) scapulae. Interestingly, we discovered a W-shaped notch in 2 (1.44%) scapulae.[17]

Pushpa NB et al.2014, Studied 176 dry scapulae. Among 176 scapulae 88 were right sided and 88 left sided. With 24 on the right side and 37 on the left, Type II suprascapular notches were the most prevalent type in the study. Type IV, with five on each side, was the least prevalent. Furthermore, there was no notch at all on 8 scapulae.[18]

Hanan N. Gadallah et al.2019, Studied hundred scapulae out of 56 were right side and 44 were left sided. The V-shaped suprascapular notch was the most common form, followed by the U-shaped one, while the flat shape was the least common. In 14% of scapulae, there were no foramen visible at all. There were 44.2% of scapulae with V-shaped notches (16 on the right and 22 on the left). Only 16.3% of scapulae had flat suprascapular notches, compared to 39.5% with U-shaped notches (12 on the left and 22 on the right). (8 on the left and 6 on the right).[19]

Perumal. A et al.2014, Proposed system of Classification of supra scapular notch in Tamil Nadu population out of 240 dry human scapula.The most prevalent kind

of notches were J-shaped, followed by U-shaped and V-shaped notches. There were also visible fully and partially ossified ligaments that converted the notch into a foramen. Finding multiple notches was also a novel observation.[20]

Aradhyula Himabindu et al.2013, Studied 43 dried human scapula. Three different types of supra scapular notches. The scapula shown U, V and J shaped notches, formed by ossification of the transverse scapular ligament, and co-existence of notch and foramen due to ossification of the anterior supra scapular scapular ligament.[21]

S.R sinkeet et al. 2010, Based on Renga-Chary's description, six types of notches were identified in a study involving 138 scapulae from the Kenyan population. 135 scapulae (97.8%) had the suprascapular notch. Found in 40 scapulae (29%), kind III is the most common kind. It is a systematic U-shaped notch with approximately parallel sides.[26]

Iqbal, k.et al 2010. Examined 250 dried scapulae for variations of supra scapular notch. 55 U-shaped, 45 V-shaped, and 55 J-shaped suprascapular notches were among the three varieties they described. Additionally, there were instances in which the notch was missing.[15]

K. Natsis et al.2007, Study 243 dry scapulae from the Department of Anatomy at the University of cologne in Germany. There were five distinct type of supra scapular notch (8.3%) type 1, without a distinct notch. Type 2 a notch with a transverse diameter of 177 (41.85%) that was the longest type third, a notch with a vertical diameter of 177 (41.85%) that was the longest ;31 (7.3%) type 4: A Bony foramen and type V, with a Bony foramen and notch, three.[4]

Brijesh Kumar R et all.2017, study 136 dry human scapulae and measured various parameter, they found various types of suprascapular notch and shape. They found 8% scapulae with complete suprascapular foramen and 5 % partial ossified suprascapular ligament. One known cause of suprascapular nerve entrapment neuropathy is an ossified superior transverse scapular ligament. It is crucial to comprehend how frequently this ligament ossifies.[7]

Michał Polguj et all 2011, A total of 86 human scapulae were included in the study. Two approaches were used to assess the suprascapular notch (SSN): conventional osteometry and a novel method that uses Multi Scan Base v.14.02 software to analyze digital pictures. Five sorts of SSNs were identified by this study: Type I: The greatest depth exceeds the superior transverse diameter in 24.4% of cases. Type II: The maximum transverse diameter, superior transverse diameter, and maximal depth are all the same in 2.3% of cases. Type III: The

superior transverse diameter is longer than the maximum depth in 54.7% of cases. Type IV: A bony foramen is the notch in 7% of cases. Type V: A little notch is seen in 11.6% of instances. Three variants were further distinguished from Types I and III: The superior transverse diameter (STD) is shorter than the maximal transverse diameter (MTD) in subtype A. Type B: MTD and STD are equal. Subtype C: MTD is less than STD in length. In 7% of cases, the superior transverse suprascapular ligament was entirely osseous, while in 23.3% of cases, it was partially osseous. Germany, France, and Italy all had ossification rates for this ligament that were comparable to those of the Polish population.[36]

Ajay kumar et all 2014, 268 human scapulae of unknown sex—126 from the right and 142 from the left—from the Dayanand Medical College and Hospital's Department of Anatomy in India were the subject of the investigation. Type II suprascapular notch accounted for the majority (50.00%), with Type I (32.46%), Type IV (9.70%), and Type III (7.84%) following in order of prevalence. The average transverse diameter of Type II notches on the right side was 9.1±3.2 mm, while the average vertical diameter was 5.2±1.9 mm. The dimensions of the left side were 5.1±1.8 mm for the vertical diameter and 9.2±2.4 mm for the transverse diameter. Type II notches often had a greater transverse diameter than Type III notches. V-shaped notches were present in 2.99% of cases, compared to 51.49% of U-shaped notches.[37]

Marcin sibinski et all,2014, Three components comprised the research, which involved 812 specimens: a radiological analysis of scapula CT scans, an anatomical investigation of formalin-fixed cadaver shoulders, and an anatomical study of dry scapulae. Because there is less room under this bony bridge than in cases where the ligament is ossified in the shape of a fan, the ossified, band-shaped superior transverse scapular ligament is thought to be a potential risk factor for suprascapular nerve entrapment. This may help explain why, despite notable differences in the occurrence of the ossified superior transverse scapular ligament, neuropathy develops at comparable rates in various populations.[38]

Sushma daripelli et all,2020, The classification of suprascapular notches in 200 human dry scapulae was done using the descriptions provided by

Rengachary et al. A suprascapular notch was present in 172 (86%) of the 200 scapulae that were analyzed. Nine individuals (4.5%) exhibited partial ossification, while 19 individuals (9.5%) displayed complete ossification.
There were six different kinds of suprascapular notches found:
51 (25.5%) are Type I. Type II: twenty-five (22.5%)64 (32%), of type III11 (5.5%) of type IV Nine (4.5%) of Type V Category VI: Ten percent (20) The most

prevalent kind of notch was Type III. Additionally, the study discovered a moderately strong positive linear link between the Type III notch's safe zone and the scapula's breadth.[39]

Gargi soni et all,2012, The study looked at 100 scapulae from the bone rooms of the Pandit BD Sharma Postgraduate Institute of Medical Sciences (PGIMS) in Rohtak and the Department of Anatomy at Maharaja Agrasen Medical College (MAMC) in Agroha. The purpose of the study was to measure and characterize the suprascapular notch in the Indian population living in the northwest. The most prevalent form was form II, which indicates a decreased risk of suprascapular nerve entrapment when the transverse diameter is larger than the vertical length. On the other hand, Types III, IV, and V were linked to a greater danger of entrapment of nerves. No clear clinical correlation has been found between the form of notch and the risk of suprascapular nerve entrapment, despite suggestions suggesting a narrow "V"-shaped notch increases the risk of nerve entrapment. Therefore, rather than the shape and diameter of the notch, the morphology of the STSL has been identified to be associated with suprascapular nerve entrapment.[40]

D. Agrawal et all.2015, The present study comprised of detailed work done on 728 dried adult north Indian human scapulae, these scapulae were obtained from museum of Department of Anatomy in various medical colleges used for undergraduate teaching purposes. These bones were of unknown age and sex. Complete ossification of the superior transverse scapular ligament, which converted the notch into a foramen, was observed in 7.14% scapulae in our study. We observed degree of ossifications of STSL in relation to MTSB (6.75 ± 1.28 mm) (Table 6). Partial ossification of STSL was observed in 5.76% scapulae, which is a nearly equal to observations made by Surekha [22]. Complete ossification in the form of thin and thick superior transverse scapular bar was observed (respectively in 4.67% and 2.47% scapulae. Our study observed and included 728 dried human scapulae which is much higher than number of scapulae studied in different studies done in Asian population (Jadhav et al.,392 scapulae; Iqbal et al., 250 scapulae; Sutaria et al.,314 scapulae; Kumar et al., 268 scapulae). Therefore, our study can provide more accurate assessment of notch. According to published and documented case reports, variations in morphology of superior transverse scapular ligament caused due to its partial or complete ossification was identified to be one of the predisposing factors for suprascapular nerve entrapment.[41]

R Vandana et all 2013, study on 134 dry scapulae from the north Karnataka region, and categorized the SSN into several shapes based on the descriptions provided by Natsis et al. and Iqbal et al. According to Iqbal et al.'s classification,

W-shaped notches were found to be least common (0.7%) and 'U'-shaped notch most prevalent (35%) respectively. 12.6% of STSL cases involved total ossification. Natsis classified the most common kind as type II (TD>VL), observed in 69% of cases, and the least common as type VI (notch & foramen), observed in 0% of cases. The average separation between the posterior rim of the glenoid cavity and the medial wall of the spinoglenoid notch at the base of the scapular spine was 13 mms ± 0.2, and the mean distance between the SSN and the supraglenoid tubercle was 27.3 mms ±1.7. These measurements are relatively smaller than those of the other population studies that are mentioned in the article.[42]

Usha kanan et all 2014, study on 400 human dry scapulae that were procured from the Department of Anatomy of eight medical colleges. According to the description provided by Rengachary et al., the type of suprascapular notch was identified and recorded. Forty (10%) of the 400 scapulae in our investigation had fully ossified superior transverse scapular ligaments. Type I (20%), Type II (10%), Type III (52%), Type IV (-4%), Type V (-4%), and Type VI (10%) were the frequency of the different types of suprascapular notches.[43]

Shalom Elsy Philip et all 2017, The anatomy department of Mysore Medical College examined 100 dry scapulae of undetermined age and sex. Variations in the suprascapular notch were observed, and digital Vernier calipers were used to measure its measurements. Every scapula possessed a suprascapular notch. U-shaped notches were typical. According to the Rengachary categorization, Type VI (3%) was the least common and Type III (36%) was the most common. The percentage of scapula that did not meet the safe zone distances between the posterior margin of the glenoid cavity and the spinoglenoid notch was 21% and 3%, respectively, from the suprascapular notch to the 33 supraglenoid tubercle. It was frequently observed in Type II and Type IV.[44]

N Chabra et all 2016, The classification system suggested by Iqbal and Natis et al. is the foundation for the current investigation. For the study, 126 scapulae from North Indian people were collected. The morphology and morphometric measurements of every suprascapular notch were examined. According to the investigation, kind II suprascapular notch (TD>VL), which was present in 47.6% of specimens, was the most prevalent kind. U-shaped SSNs were the most frequently discovered (46%) followed by V- and J-shaped SSNs (24.6% and 15.9%, respectively). In contrast, in 2.4% of cases in our investigation, the entire ossification of STSL leading to the creation of a bony foramen was detected. Notably, neither a notch nor a bony foramen was identified simultaneously in a single scapula.[45]

S. Gupta et all,2017, A total of 120 adult scapulae, both male and female, will be acquired from the GMERS Medical College's anatomy department in Gandhinagar and Sola, Gujarat, India. SSN shapes were examined, and a digital Vernier caliper was used to measure the dimensions. Form 2, which has the longest transverse diameter notch, was the most prevalent form of SSN found. Type 4 was the least prevalent type. There was no Type 5 SSN.
The shape "J" was the most popular, while "V" was the least popular. Additionally, partial and total ossification was seen.[46]

MVR. Mayuri et all 2020,60 adult dried human scapulae, of unknown sex and age, were acquired from Sri Venkateswara Medical College's anatomy department in Tirupati. Notch presence or absence was noted, along with its shape. The most prevalent notch was determined to be type III based on the Rengachary categorization. Five scapulae were found to have suprascapular foramen. The measurements of the mean transverse and vertical diameters were 9.81 mm and 6.43 mm, respectively. Correlating suprascapular nerve entrapment with a particular type of notch is made easier by studying the morphology and morphometry of the suprascapular notch.[47]

N. boyan et all 2018, From Cukurova University Medical Faculty's anatomy lab, 73 undamaged adult scapulae of unknown age and sex were chosen and studied. The definition provided by Rengachary et al. was used to classify the suprascapular notch (SN)**.** The shape (type I: cobra, type II: square, type III: intermediate) and tilt (type I: flat, type II: curve) of the acromion were used to determine its kind. Measurements were also made of the acromion's length and the separation between it and the coracoid process. Type I (28.8%), type II (23.3%), type III (13.7%), type IV (20.5%), type V (2.7%), type VI (5.5%), and absence (5.5%) were the frequencies of the various types of suprascapular notches. Acromion types were type I (45.5%), type II (7.5%), and type III (47.0%); type I (15.2%) and type II (84.8%) were the acromion tilts. [48]

A. Patra et all 2016, A six-month period was spent grossly examining 110 dried human scapulae that were taken from the bone room of the Government Medical College in Patiala**.** 43 "J" shaped scapulae (39.09%), 35 "U" shaped scapulae (31.81%), 10 "V" shaped scapulae (9.09%), indentation in eight cases (7.27%), absent in five (4.54%), partial ossification of STSL in four (3.63%), and complete ossification in five (4.54%) scapulae were detected based on shape classification. After removing the Scapulae with indentation and incomplete ligament ossification, the data were also analyzed using the Natsis classification. There were five (5.1%) scapulae with Type I, sixty-six (67.34%) with Type II, fourteen (14.28%) with Type III, five (5.1%) with Type IV, and zero (0%), with Type V.

Additionally, we discovered that the transverse diameter (Td=Vl) of eight scapulae (8.16%) matched the vertical diameter.[49]

LV.VG et all 2022, 200 adult dry ossified human scapula bones were gathered from first-year anatomy students and the Department of Anatomy. Yenepoya Medical College's MBBS program. Maximum breadth and projection length of the scapular spine, as well as the maximum length of the 100 right and left scapulae the coracoid process was more prevalent on the scapula on the right. There was a greater left-sided variation in the suprascapular notch's superior-transverse dimension, maximal depth morphological length and width, and scapular index. This indicates that the left scapula is marginally shorter than the right, with the mean scapular index of the right side being 70.11 and the left side being 70.26. Additionally, scapulae with a longer maximal depth of suprascapular notch (MD>STD) (24%), and scapulae with a shorter superior transverse diameter of suprascapular notch (STD=MD) (52%) were more common than those with the latter two characteristics. Only 15% of scapulae had absent notches. Frozen in 12% of cases was the superior transverse scapular ligament. More of the "U-shaped" suprascapular notch is visible on the left and right scapulas. Anthropometric measurements of the group with a higher maximal depth and the group with a higher superior transverse diameter of the suprascapular notch did not differ statistically significantly.[50]

AY Nasr 2023, The purpose of this investigation was to distinguish between the many morphological and morphometric kinds of suprascapular notch (SSN). In the current investigation, 60 formalin-embalmed cadaveric upper limbs (40 males and 20 females) and an unknown 120 dry human scapulae on both sides were used. There have been reports of SSN in three primary morphological forms: J, U, and V-shaped. The most common type of notch was J-shaped, which was followed by U-shaped and finally V-shaped. Morphometrically, type (III) notch was the most common in cadavers and dry bones, whereas type (II) notch had the lowest prevalence. Furthermore, no discernible differences in side or sex were found in the measures of the superior transverse diameter, middle transverse diameter, or vertical dimension of the various notch types. In 5.8% of dry bones and 10% of cadaveric specimens, the suprascapular foramen with ossified superior transverse scapular ligament (STSL) was observed. Ossified transverse scapular ligaments with fan and band shapes have been documented. 10.8% of dry bones, 7.5% of male specimens, and 10% of female specimens with a left side predominance were found to be missing their SSN. The presence of ossified STSL, absence of V-shaped STSL, and both were thought to be risk factors for suprascapular nerve entrapment syndrome.[51]

M J Akhtar et all 2015, 226 (Right-111, Left-115) dried human scapulae of unknown age and sex were acquired from the following institutions: Lord Buddha Koshi Medical College (Saharsa, Bihar, India), Patna Medical College (Patna, Bihar, India), Nalanda Medical College (Patna, Bihar, India), and the Department of Anatomy and Department of Forensic Medicine & Toxicology of the Indira Gandhi Institute of Medical Sciences (Patna, Bihar, India). The current investigation revealed five distinct forms for suprascapular notches. 81 (35.84%) of the 226 scapulae have a deep U shape, whereas 72 (31.86%) do not. 49 (21.68%) of the scapulae had a shallow U shape. Scapulae are classified as J Shaped, V Shaped, or indented suprascapular notch in 11 (4.875%) and V Shaped (5.75%) scapulae, respectively. Of the various shapes of suprascapular notches, the Deep U shape is the most prevalent, while the Indented form is the least common.[52]

C. Manikum et all 2015, 200 dried cadaveric scapulae of known sex, age, and race were chosen, 30 on the right and 30 on the left. The study was carried out on the skeletal collections in the Department of Clinical Anatomy at the University of KwaZulu Natal's School of Laboratory Medicine and Medical Science, located on the campus of the medical school. We measured the notches' maximal depth and superior transverse diameter. The notch was compared to sex, laterality, and the maximum breadth and length of the scapulae. To characterize the SSN's shape, the Rengachary classification approach was utilized. The Type II-wide blunted V-shaped notch was found to be prominent (65%) in the analysis of morphological variants. There were three scapulae without notches (Type I). The transverse diameter was 13.18±5.52 mm and the average notch depth was 6.51±2.69 mm. Significantly deeper than the left SSN (7.54±2.51 mm) was the right SSN ($p<0.02$). Male scapulae were much bigger than female ones, with the female notch being significantly shallower and wider. The Type II-wide bigger than female ones, with the female notch being significantly shallower and wider.[53]

S. Patil et all 2019, A total of 118 human scapulae, 61 from the left and 57 from the right, were analyzed in order to determine the dimensions and properties of the suprascapular notch. Thirteen female and thirty-five male adult skeletons comprised the sample, the existence of any suprascapular ligament ossification, and their classification into types I–VI in accordance with Rengachary et all. All bones obtained from Maulana Azad Medical College, New Delhi. We discovered the following types of scapulae after analyzing the morphological variations of the suprascapular notch: The results of a study including various specimen kinds revealed the following percentages: Type II had a value of -12.98%, Type III had a value of -53.98%, Type IV had a value of 0%, Type V had a value of 7.08%, and

Type VI had a value of -3.54%. Remarkably, only three specimens (3.54% of the total) possessed fully ossified (hardened into bone) suprascapular ligaments.[54]

MR. Sangam et all 2013, The 104 scapulae used in this study were acquired from the NRI Medical College's Department of Anatomy as well as from other local medical colleges. Based on the descriptions provided by Rengachary et al. and Ticker et al., the suprascapular notches in the scapulae were categorized. According to the Rengachary categorization, type III notches were more prevalent. Two scapulae showed evidence of the suprascapular foramen. The superior transverse diameter in 56.73% of scapulae was larger than the maximum depth. The U-shaped notch had a higher frequency (69.23%). The safe zone distances from the glenoid cavity boundary were not met by 2.88% and 8.65% of the scapulae, respectively.[55]

MM El Nahla et all 2022, 55 dried adult scapulae of unknown sex were acquired from the Department of Anatomy at the Kasr Al-Ainy Medical School in Cairo, Egypt's The Bone Bank**.** Among the Egyptian scapulae analyzed in this study, type II is the most common type (47.3%), followed by type III (29.1%) according on the frequencies and percentages of SSN kinds. 9.1% (type I) do not have an SSN. In 1.8% of cases where the notch is absent (type VI), the superior transverse scapular ligament is entirely ossified.[56]

K. Santosh et all 2020,112 dried human scapulae, unknown in age and sex, from the Mahatma Gandhi Medical College and Hospital's anatomy department in Jaipur. Every scapula is meticulously examined. Of all the scapulae that we looked at for our study, 42 (37.5%) had a U-shaped suprascapular notch, 21 (18.75%) had a J-shaped notch, 33 (29.4%) had a V-shaped notch, 7 (6%) had an indentation where the notch would be, and 3 (2.6%) had none at all. Six (5.3%) of the scapulae had the superior transverse scapular ligament osseous, resulting in the conversion of the suprascapular notch into a foramen.[57]

DV Singh 2018, The ossified, dry, and intact scapulae of fifty-eight individuals on both sides were removed, and measurements were made of the glenoid cavity's morphological shapes, the acromion's tip shapes, the types of inferior surface acromion processes based on appearance, The maximum length, width, thickness, acromio-glenoidal distance, superior-inferior glenoid diameter, and both anterior-posterior glenoid diameters were among the scapula's properties that we measured. Acromion tips were characterized by the following shapes: 16 square, 14 cobra-shaped, and 28 intermediate on the right side; 18 square, 13 cobra-shaped, and 27 intermediate on the left. The left side featured 33 curved, 13 flat, and 10 hooked acromion process types, while the right side had 32 curved, 12 flat, and 12 hooked.

Finally, in 34 instances, the acromion's inferior surface was smooth, while in 22 cases, it was rough. In 24 and 23, the glenoid cavity had oval shapes. Inverted comma in 10 and 13, and pear in 22 and 20, respectively. There was a substantial difference ($P<0.05$). The maximum length (mm) and breadth (mm) of the scapular parameters on the right and left sides were 150.2 and 150.6, respectively, while the width / length index (%) was 70.4 and 70.6. The maximum length (mm) and maximum width (mm) of the acromion parameters on the right and left sides were 51.6 and 51.4, respectively, and the maximum thickness (mm) was 9.5 and 9.0. The measurements of the acromio-glenoidal distance (mm) were 28.7 and 28.2, and the acromio-coracoid distance (mm) was 31.2 and 30.6. The glenoid measured 22.4 mm on one side and 21.3 mm on the other for the initial anterior-posterior glenoid diameter. The diameters of the second anterior-posterior glenoid were 29.5 mm and 28.8 mm, whereas the superior-inferior glenoid was 37.4 mm and 38.0 mm. In these measurements, we discovered a significant difference ($P<0.05$).[58]

U. Desai et all 2018, Two hundred dried, undamaged adult human scapulae of mixed sex, Indian descent, from different Gujarati medical colleges were examined. (Government Medical College, Baroda; B. J. Medical College, Ahmedabad; Pramukhswami Medical College, Karamsad; and Government Medical College, Surat) form 2, which has the longest transverse diameter notch, was the most prevalent form of SSN found. Type 4 was the least prevalent type. There was no Type 5 SSN. The shape that was most popular was “J,” whereas “V” was less popular. Ossification, both partial and total, was also observed.[59]

S. Roy et all 2022, One hundred dry scapulae that were already housed in the government medical college in Kolkata, West Bengal’s Museum of Anatomy. 100 scapulae were examined for the maximum and minimum depths of suprascapular notches, and the system Natsis devised was used to classify them. We discovered that the suprascapular notch (Type I) was lacking in 5% of our samples. The scapulae in 72% of the bone samples had Type II (maximum depth < superior transverse diameter) characteristics. 6% of cases had Type IV (existence of suprascapular foramen) and 17% had Type III (maximum depth > superior transverse diameter). There was no evidence of a type V scapula, which has a foramen and suprascapular notch present at the same time. Therefore, rather than being deeper, the suprascapular notches were observed to be wider in the majority of scapulae.[60]

A. Bayramog˘lu et all 2003, The research was done on 32 shoulders—four female and twelve male cadavers—that ranged in age from 39 to 74 years old (mean=56.4 years).
Standard dissections of the shoulder region had already been performed on five of

the cadavers. Thus, the anterior technique was used to evaluate the superior margins of the scapulae. In five shoulders out of the 16 cadavers, we found that the subscapularis muscle's abnormally oriented superior fibers covered the whole anteroventral surface of the suprascapular notch, severely restricting the amount of space available for the suprascapular nerve. Additionally, we found calcified superior transverse scapular ligaments in four of the 32 shoulders and anterior coraco scapular ligaments in six of the 32 shoulders. We categorized the variants for this study. In conclusion, understanding the precise anatomical variations along the suprascapular nerve's course may be crucial for determining the exact location and etiology of entrapment syndrome, particularly for those who participate in intense overhead sports like baseball and volleyball. It has not previously been suggested that the tight association between the subscapularis muscle and the suprascapular nerve may be a risk factor for suprascapular nerve entrapment.[61]

A. Badar et all 2022, In all, 128 human scapulae, regardless of gender, were removed between January and June of 2021 from the anatomy departments of the Saidu Group of Teaching Hospitals, Swat, and Women Medical and Dental College Hospital, Abbottabad. The incisura inferior border shape and vertical diameters were used to establish the four characteristics of the suprascapular notch (SSN): i) superior transverse depth (STD), ii) maximum depth (MD), iii) middle transverse diameter (MTD), and total circumferential diameter (TCD). Every scapula had its suprascapular notch presence or absence thoroughly inspected. 61 (47.7%) of the 128 human scapulae were lateral, and 67 (52.3%) were lateral. U-shaped, V-shaped, and J-shaped notch prevalences were 62 (48.4%), 27 (21.1%), and 13 (10.2%), in that order. Large double foramen, complete suprascapular notch, and incomplete suprascapular notch incidences were 2 (1.6%), 7 (5.5%), and 8 (6.3%), respectively. Three (2.3%) of the scapulae had a W-notch, while six (4.7%) did not. For type-II scapulae on the right and left sides, the corresponding vertical and transverse diameters were 4.9±2.1 mm and 8.9±3.1 mm, and 4.8±1.7 mm and 9.1±2.3 mm, respectively.[62]

JD de Lucena et all 2021, In the anatomy labs of the Federal University of Ceará (UFC), State University of Health Sciences of Alagoas (UNCISAL), and Integrated Faculties of Patos (FIP), all situated in Northeast Brazil, 97 dried human scapulae (55 right and 42 left) were examined. Among the scapulae under study, the SSN was visible in 70.10% of cases, lacking in 29.90%, and none of them had a bony foramen. In light of Natsis et al., type II SSN was found on 62.88% of scapulae, more frequently than type I SSN (29.90%) and type III (7.22%). There was no sign of Types IV or V. Only 68 scapulae were examined macroscopically, and of them, 41.18% had a U form and 58.82% had a J shape, according to Iqbal et

al. No V-shaped scapula was discovered. The SSN exhibited the longest vertical diameter (type III) in 7.22% and the longest transverse diameter (type II) in 62.88%.[63]

RK Nikhumbh et all 2017, From the Department of Anatomy at the ACPM Medical College in Dhule, 106 dry human scapulae of undetermined age and sex were gathered. Nine (8.5%) out of 106 scapulae had complete ossification of STSL resulting in foramina (Type VI). 43 (40.6%) scapulae showed kind III as the most prevalent kind, followed by Type I (26.4%), Type II (17%), Type IV (4.7%), and Type V (2.8%).[64]

EO Aigbogun et all 2017,200 perfectly preserved, unpaired scapulae bones (96 on the right and 104 on the left) with full ossification; these bones are housed in the anatomy museums of a few Southern Nigerian eminimum and maximum ratio of 54% and 87%, respectively). Among the predictor variables used to estimate MGH and MGW, SSA showed a weak (-) correlation ($r<0.2$; $R2<0.1$), MSH an average (+) correlation ($r<0.55$; $R2<0.3$), and there was a strong (+) correlation between the inter glenoid cavity dimensions ($r=0.785$; $R2=0.617$).[65]

GS Dhindsa et all 2019, The study was carried out at the GGS Medical College's anatomy department in Faridkot, Punjab. A total of 85 single human scapula bones from the anatomy department's teaching collection were examined. 44 of the 85 scapulae were located on the right side, and 41 on the left. Each of the chosen scapulae was dry, whole, and displayed typical anatomical characteristics. Its age and sex were also unknown. Three distinct morphologies of the suprascapular notch (U, V, and J), ossification of the superior transverse ligament, and the absence of the suprascapular notch were seen in the current study. Thirty (35.29%), twenty-six (30.58%), and three (3.52%) of the eighty-five scapulae showed U-shaped suprascapular notch. Two (2.35%) of the scapulae had the superior transverse ligament visible as ossified, while 24 (28.23%) of the scapulae lacked the suprascapular notch.[66]

V. Nithya et all 2020,150 dried adult human scapula from Indian people, of unknown sex. SRM Medical College Hospital and Research Center, located in Tamilnadu, India in Kattankulathur. Eight (5%) and twelve (8%) of the 150 scapulae had entire foramens, while the remaining 76 (51%) and 32 (21%) had shallow U-shaped notches, J-shaped notches, and V-shaped notches. The suprascapular notch and the supraglenoid tubercle (SGT) were 3.10±0.32 miles apart on average. The posterior rim of the glenoid cavity (PGC) and the spinoglenoid notch (SGN) were 1.55±0.23 miles apart on average. The

spinoglenoid notch and the suprascapular notch were separated by an average distance of 2.09±0.29.[67]

R Saikia et all2016,236 dried human scapulae of an unidentified sex were obtained from the anatomy departments of Jorhat Medical College in Jorhat and Assam Medical College in Dibrugarh, Assam. Scapulas were also taken from the two colleges' first-year medical students. Of them, 110 had left-sided scapulae and 126 had right-sided ones. 42 (17.79%) of the 236 scapulae that were included in this study lacked a suprascapular notch on their superior border. Of these, 25 (10.59%) had left-sided scapula and 17 (7.2%) had right-sided scapula. As a result, we discovered that left side suprascapular notch absence was more common.[68]

MATERIAL AND METHODS

The present study was conducted in the anatomy department of Santosh medical college in Ghaziabad, supra scapular notch morphometric measurement is done by vernier calliper and subjective evaluation (visual inspection) is also done on 30 adult dry scapula obtained from the osteology museum department of anatomy. Morphometric parameters Superior diameter, transverse diameter, medial diameter, shape of notch, width of notch, is noted.

STUDY: observational.

SOURCE OF DATA: The study will be carried out on 30 dry adult human scapula randomly without any knowledge of age and sex of the specimen This will include 18 from the right side and 12 from the left side. All the scapula to be studied will be from the osteology museum of Anatomy department of, Santosh Medical College Ghaziabad.

Inclusion criteria: All adult intact scapula notch that are completely visual.

Exclusion criteria: Damaged scapula or supra scapular notch.

Measuring tools: -

The supra scapular notch's morphometric characteristics be measured using specialized tools: -

1.Digital Vernier calipers.

2.Rular.

3.Camera for photograph.

METHODOLOGY

The supra scapular notch type identified using the Renga-chary et al. description. [5,6] The length, width, and posterior and posterosuperior limits, as well as the dimensions of the supra scapular notch, measured classically using a digital vernier caliper.

9.METHOD OF MEASUREMENT

Depth, transverse diameter and shape of the suprascapular notch (SSN)-visual examination of the suprascapular notch is conducted and more morphometric measurements are collected with a digital vernier caliper the superior transfers diameter (STD) is the maximum value of the horizontal measurement taking in the horizontal plane between the corners of the scapular notch on the superior border of the scapula. The middle transverse diameter (MTD) is the horizontal distance, measured perpendicular to the MD and at a midpoint, between the opposing walls of the SSN.

The maximum vertical measurement is the suprascapular notch (SSN) maximal depth (MD). This is determined by measuring down to the deepest point of the notch from an imaginary line formed between its upper corners. The SSN can be divided into two categories according on its shape: (1) U-shape, which has roughly parallel sides and a rounded base and (2) V- shaped, which has medial and lateral sides that coverage into a narrow base.[5,6,7,25,39,87,91]

9.1. Measurement Procedure

9.1(a). Depth Measurement

- **Tool:** A digital caliper.
- **Method:**
    - Place one arm of the caliper at the highest point on the superior border of the scapula, just above the suprascapular notch.
    - The other arm of the caliper should be placed at the deepest point of the notch.
    - Record the vertical distance between these two points as the depth of the notch.

9.1(b). Width Measurement

- **Tool:** A digital caliper or ruler.
- **Method:**

- The width of the suprascapular notch is measured as the horizontal distance between the two edges of the notch at its widest point.
- Ensure that the measurement is taken perpendicular to the line that represents the superior border of the scapula.

9.2. Ossification Assessment

- **Observation:** Assess the degree of ossification of the superior transverse scapular ligament, as this can significantly alter the notch's structure.
  - **Partial Ossification:** The ligament is partially ossified, resulting in a partial conversion of the notch into a foramen.
  - **Complete Ossification:** The ligament is fully ossified, converting the notch into a complete foramen.

9.3. Measurement of the Foramen (if present)

- **Tool:** A digital caliper.
- **Method:**
  - If the notch has been converted into a foramen (Type V or VI), measure the diameter of the foramen.
  - Place the caliper's arms on the widest part of the foramen's opening and record the measurement.

1. The measurement of the scapula's major longitudinal axis is made from the inner angle, or medial angle, to the lower angle, or inferior angle.

II. The glenoid cavity's lowest point and the scapula's edge—more precisely, the place where the smooth surface permits the trapezius muscle to glide over it—are the locations of the primary transversal axis measurements.

III. The maximum depth of the suprascapular notch is determined by measuring the maximum vertical distance between the notch's top edge and lowest point.

IV. The suprascapular notch's maximum width is determined by measuring the notch's top edge at its curved points, from the inner to the outer side. [11]

STATISTICALLY ANALYSIS:

The obtained information was observed and tabulated. The statistical investigation was performed by applying a t-sample assuming unequal variances. mean, standard deviation, range and percentage of each parameter is recorded. For statistical analysis, Wizard 2 (IOS)was used.

Fig.10.1Anterior or costal surface of Scapula showing the "U" shaped Suprascapular Notch.

Fig.10.2. Showing posterior or dorsal surface of scapula

Fig 10.3. Showing the total ossification of the STSL (superior transverse scapular ligament).

Fig 10.4. Showing wide blunted “V” shaped suprascapular notch

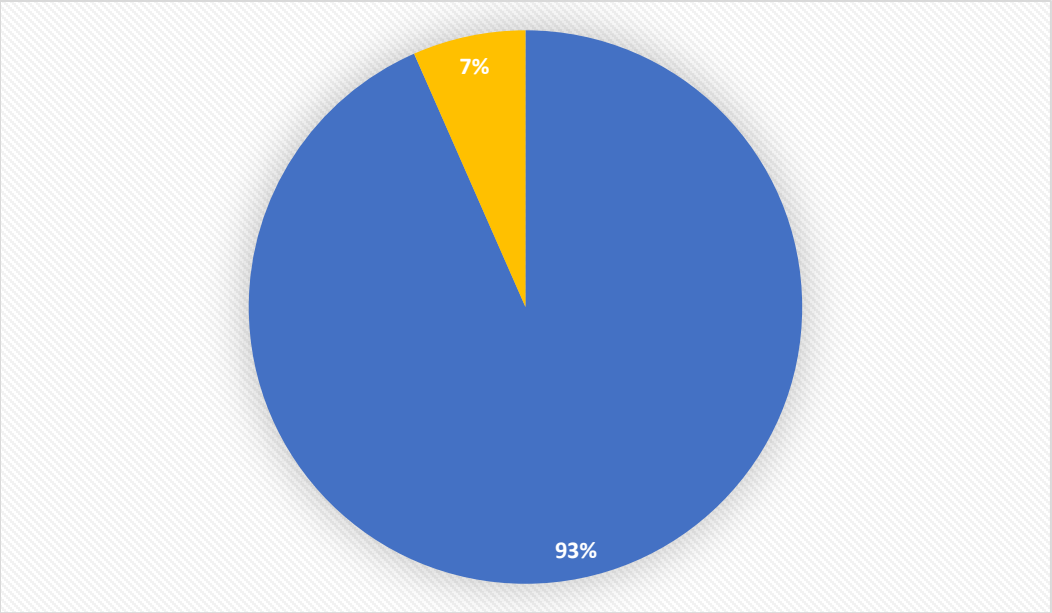
RESULT: -

The present study was conducted in the anatomy department of Santosh medical college in Ghaziabad, supra scapular notch morphometric measurement is done by vernier calliper and subjective evaluation (visual inspection) is also done on thirty adult dry scapula eighteen from right side and twelve from left side obtained from the osteology museum department of anatomy. Morphometric parameters Superior diameter, transverse diameter, medial diameter, shape of notch, width of notch, is noted. The present research is related to the visual and metric assessment of the human scapula. Damaged scapula excluded from the criteria. The digital vernier caliper used for the measurement of suprascapular notch.

Table 11.1: Showing the distribution of the sides in present research of the adult dry human scapulae.

SIDE	RIGHT	LEFT
NUMBER	18	12

NUMBER



RIGHT

LEFT

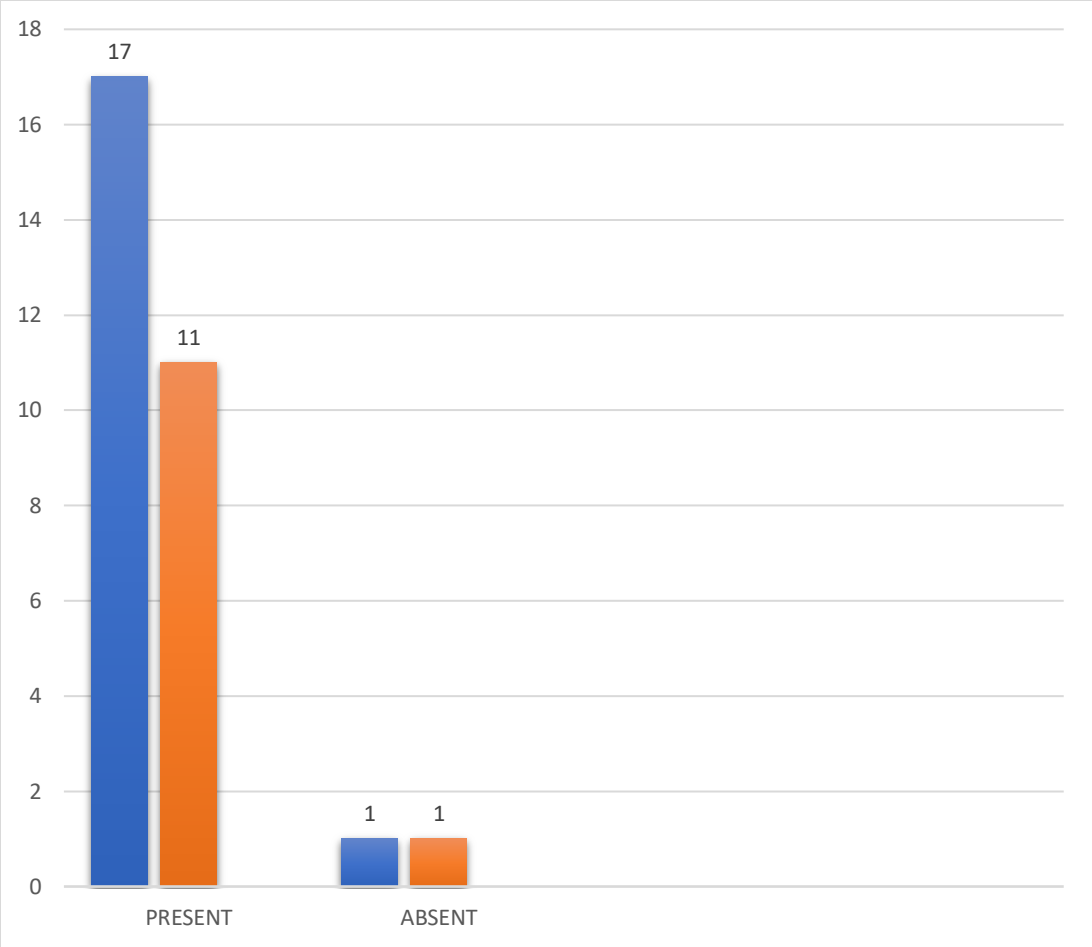
Graph 11.1: Showing the percentage distribution of the sides in present research of the adult dry human scapulae.

SUPRASCAPULAR NOTCH:

Table 11.2: Showing presence and absence of suprascapular notch in right and left scapula in recent study.

Table 1.2. showing the distribution of scapula on the basis of present and absence of suprascapular notch where we found the suprascapular notch was present in 28 scapulae out of 30, where in one absence of notch was found and in one complete ossification was seen.

SIDE	NUMBER	PREERNT	ABSENT
RIGHT	18	17	1
LEFT	12	11	1



RIGHT

LEFT

Graph.11.2. showing presence and absence of suprascapular notch in right and left scapula.

Classification of suprascapular notch

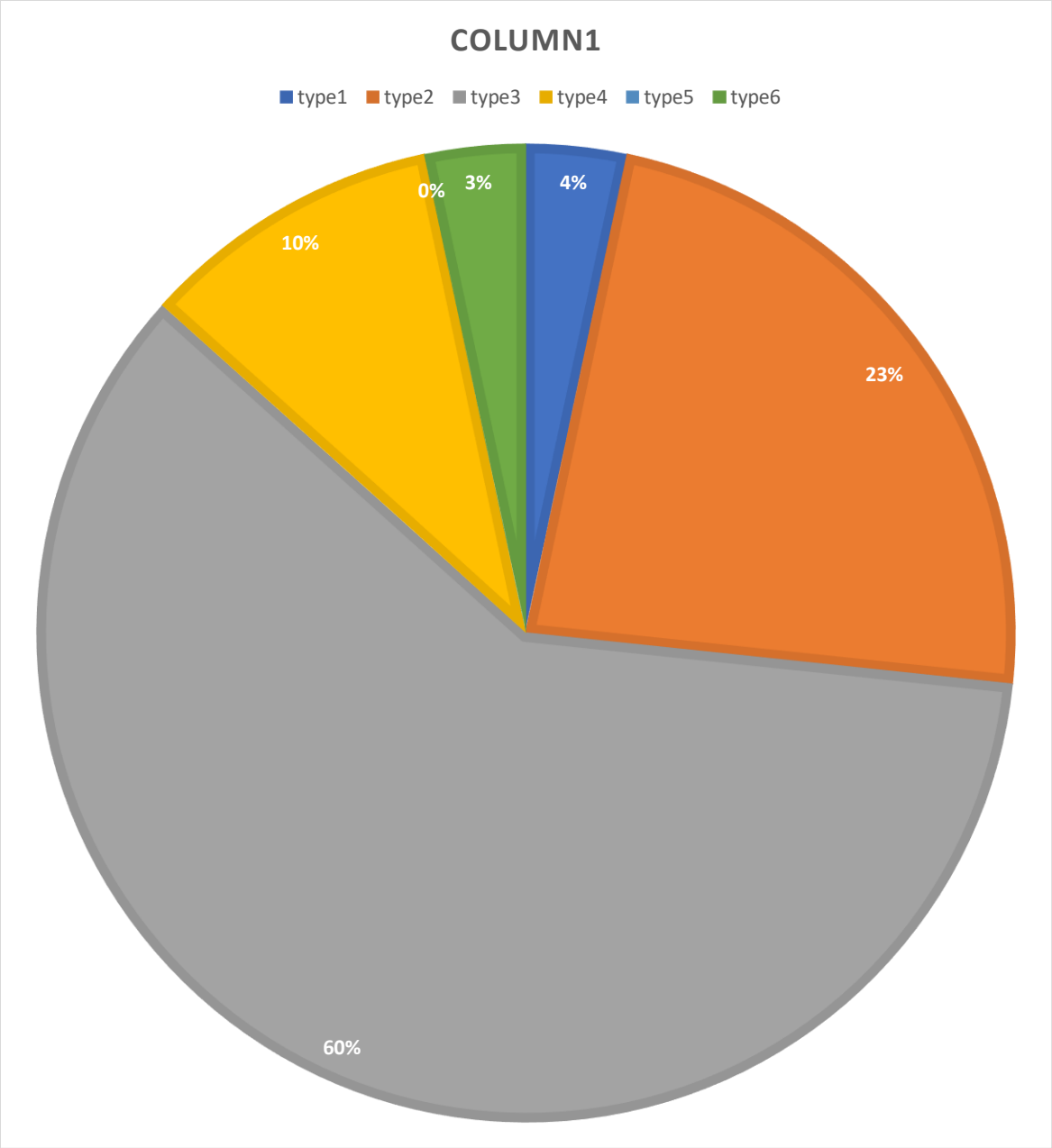
Classification of suprascapular notch, based on its anatomy, the supra scapular notch is classified into six categories by the Ranga-Chary categorization system.

Type I denotes the notch's total absence. Type II is a broad notch with a blunted V form. Type III has a parallel-sided, symmetric U-shaped notch. Type IV is a little notch with a V form. Type VI has a fully ossified ligament, whereas Type V has partial ossification.[7]

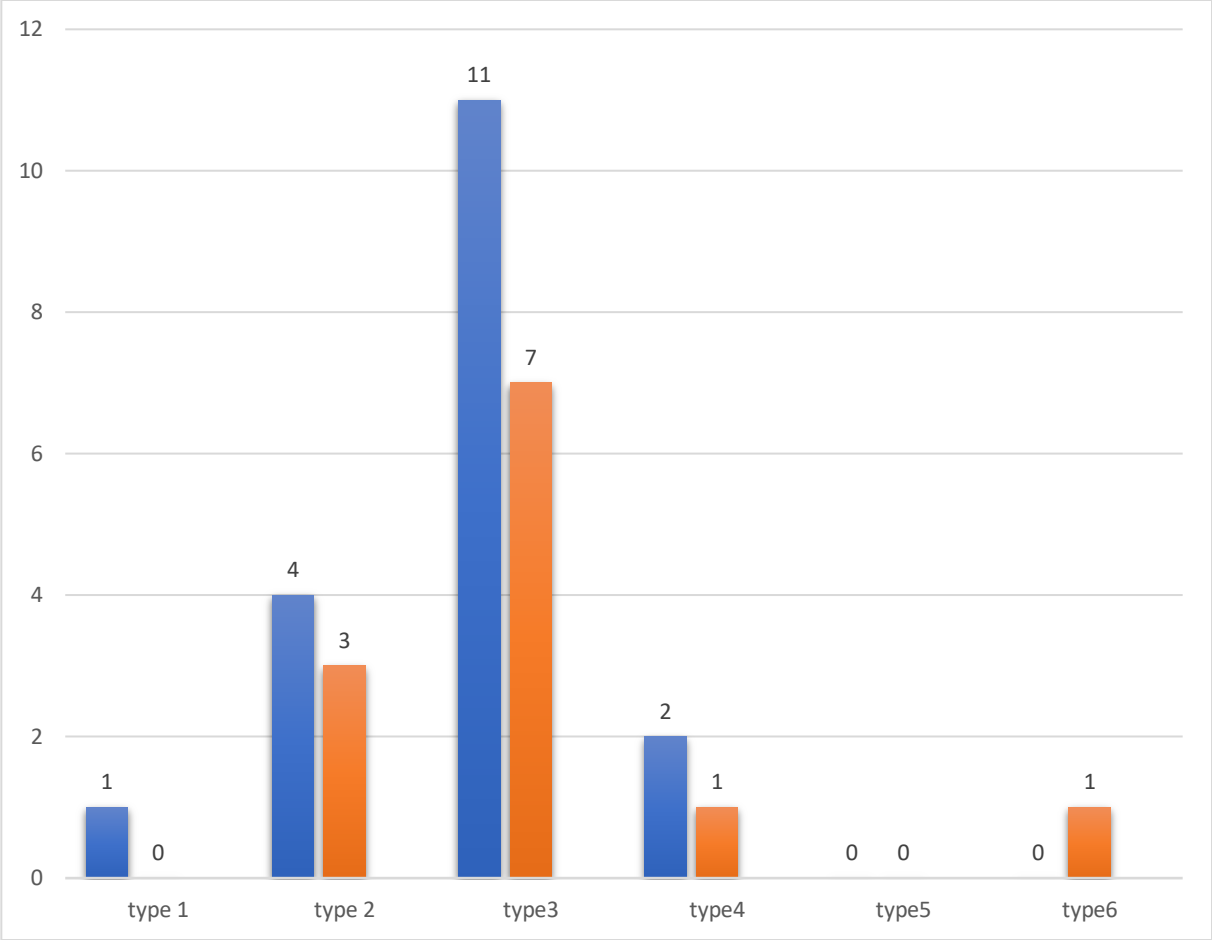
Table11.3 showing the classification of suprascapular notch on the basis of their shape, according to Ranga-Chary classification.

S. N	TYPE	RIGHT	LEFT	TOTAL
1	Complete absence of notch	1	0	1
2	Wide blunted V shaped	4	3	7
3	"U" Shaped	11	7	18
4	Small "V" Shaped	2	1	3
5	Partial ossification	0	0	0
6	Complete ossified ligament	0	1	1

Graph 11.3(a). In graph 11.3(a) 30 scapula was analyzed and complete absence of notch in found in 1(4%). Wide blunted V shaped 7 (23%). U shaped 18 (60%). Small V shaped 3(10%). Partial ossification 0(0%). And complete ossification 1 (3%) was found. The most prevalent notches were U-shaped ones, which were followed by V-shaped ones. In 3% of the instances, the ligament was determined to be completely osseous.



Graph 11.3(a): showing percentage occupying by each type of suprascapular notch



Graph 11.3(b): Showing value of different types of suprascapular notch in right and left scapula.

RIGHT

LEFT

Table no.1.3 According to Table 1.3, V-shaped notches are the least prevalent, whereas U-shaped notches are more common. One scapula shows absence the SSN, and one scapula showed full ossification of the superior transverse ligament, with the notch entirely transformed into a foramen. Partial ossification not seen in any scapula.

Table 11.4 showing STD, MTD, and MD of different type of notches (Ranga-Chary classification.

TYPE OF NOTCH (Ranga-Chary classification)	STD	MTD	MD
TYPE-1	-	-	-
TYPE-2	9.75 ± 1.35	4.06 ± 0.91	4.39 ± 1.12
TYPE-3	9.97 ± 2.69	6.18 ± 1.12	6.79 ± 2.02
TYPE-4	6.31 ± 1.27	4.05 ± 1.00	5.92 ± 8.10
TYPE-5	-	-	-
TYPE-6	-	-	-
P-VALUE	<0.01	<0.01	0.02

Presence and absence of suprascapular notch were noted and its statical evaluation is done to find out P- value. Some STSL is ossified and form a foramen which were also noted.

DISCUSSION: -

Many researchers have identified and documented many physical variants and classifications of the suprascapular notch (SSN) in various populations.[4,16,24,78,79,]80The ossification of the superior transverse scapular ligament and variations in the form of the suprascapular notch can both lead to suprascapular nerve entrapment.[37,76,81,82]

The suprascapular notch's shape has been studied in a variety of populations, and different writers have assigned it different classifications. The first person to categorize suprascapular notches into five categories was Hrdlicka (1942) [4]. Rengachary et al. (1979)[6,7] divided scapular notches into six categories based on their study of the American populace. Ticker and Co. (1998). Bayramoglu et al. (2003) and [24]. [6,7], changed Rengachary et al.'s (1979) categorization[7], and contained just three varieties. Iqbal and associates (2010).[16] conducted research on the population of Muslims and divided scapular notches into three categories: "U," "V," and "J."

	Type1	Type2	Type3	Type4	Type5	Type6
Ranga-chary et al (America)	6%	24%	40%	13%	11%	6%
Nastis et al (Greek)	8%	31%	48%	3%	6%	4%
Sinkeet et al (Kenya)	22%	21%	29%	5%	18%	4%
Muralidhar et al (India)	21.15%	8.65%	59.61%	2.88%	5.76%	1.93%
Present study (India)	4%	23%	60%	10%	0%	3%

Table11.5: Showing using the Ranga-Chary categorization, the distribution of distinct suprascapular notch types in different groups was compared. This

categorization aids in identifying the many kinds of notches and illustrates how their prevalence differs among various demographic groups.

According to depth, width, and the widest point inside the notch, Rengachary et al.[6,7] categorized the notches and indicated that smaller notches have a higher risk of impinging on a nerve.

The suprascapular nerve entrapment syndrome is caused by "V" shaped notches, which have a smaller area than "U" shaped notches, according to research by Dulkengrun et al.[15]. The 'V' shaped suprascapular notch was also discovered to be frequently linked to suprascapular nerve entrapment syndrome by Cummins et al.[71]. outlined how the likelihood of nerve impingement is higher in little notch.

The scapulae of type VI (full ossification of the ligament) were reported in 30.76%, 3%, 7%, and 3%, respectively, by Silva et al. (2007) [119], Sinkeet et al. (2010)[28], Polguj et al. (2011)[25], and Soni et al. (2012)[41]. By Natsis et al. (2008)[5], two of the 204 scapulae were found to have a bony foramen inferiorly and a notch superiorly.

(2007), Natsis et al.[5]. measured both vertically and transversely to classify the suprascapular notch. Type I denotes the total lack of a discernible notch. The Type II notch has the widest transverse diameter. The notch of Type III is the tallest (vertically diameter). Type V has a notch and a foramen, while Type IV is a bony foramen.

According to Soni et al. (2012) [41], transverse diameter exceeds vertical diameter in 72% of scapulae and vertical diameter exceeds transverse diameter in 20% of scapulae. According to Apurba Patra et al.'s study,[50] 67.34% of scapulae have notches whose breadth is larger than their height. On the other hand, the height exceeds the breadth in 14.28% of the situations.

	Type1	Type2	Type3	Type4	Type5
Nastis et al. (Greek)	8.30%	41.85%	41.85%	7.30%	0.70%

Wang et al. (Chinese)	**28%**	**56.16%**	**28.23%**	**3%**	**-**
Muralidhar et al (India)	**21.25%**	**56.73%**	**14.42%**	**1.92%**	**-**

Table 11.6: Using the Nastis categorization, the frequency of distinct suprascapular notch types in different populations was compared. In addition to showing how frequently each type appears in various populations, this classification aids in the identification of the many types of notches.

One possible factor contributing to the risk of nerve entrapment is the size of the suprascapular notch. The risk of suprascapular nerve entrapment is higher in smaller suprascapular notches than in bigger ones.

CONCLUSION

Introduction-The scapula, or shoulder blade, is a flat, triangular bone found on the upper back, between the second and seventh ribs. A small groove, known as the suprascapular notch, is located near the base of the coracoid process at the outer end of the top border. This groove is turned into a small opening by a ligament called the superior transverse scapular ligament, which allows the suprascapular nerve to pass through. The Ranga-Chary classification system is a way of classifying the supra scapular notch's morphology that was first presented by Ranga-Chary et al. in 1989.

Types of notch-Type I: There is no notch at all.
Type II: V-shaped notch, broad and blunted.
Type III: U-shaped notch that is symmetrical and has parallel sides.
Small V-shaped notch (Type IV).
Type V: A partially hardened (ossified) material.
Ligament that has entirely stiffened, or ossified (type VI).[7]

Method and material- The present study was conducted in the anatomy department of Santosh medical college in Ghaziabad, supra scapular notch morphometric measurement is done by vernier calliper and subjective evaluation (visual inspection) is also done on 30 adult dry scapula obtained from the osteology museum department of anatomy. Morphometric parameters Superior diameter, transverse diameter, medial diameter, shape of notch, width of notch, is noted.

Aim-To conduct a comprehensive morphometric analysis of the suprascapular notch in the Western UP population, aiming to contribute to the understanding of anatomical variations and potential clinical implications.

Result-30 scapula was analyzed and complete absence of notch in found in 1(4%). Wide blunted V shaped 7 (23%). U shaped 18 (60%). Small V shaped 3(10%). Partial ossification 0(0%). And complete ossification 1 (3%) was found. The most prevalent notches were U-shaped ones, which were followed by V-shaped ones. In 3% of the instances, the ligament was determined to be completely osseous.

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LETTER OF ETHICAL CLEARANCE FOR DISSERTATION FROM REGISTRAR OFFICE

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Subject: Grant of Ethical Clearance for **Dissertation Protocol** Topic **"Morphometic Study of Suprascapular Notch in Western UP",** submitted by **MANISHA SCOTT,** student of M.Sc. Medical Anatomy, 2021 Batch.

*****

With reference to the request for grant of Ethical Clearance for the Dissertation Protocol entitled **"Morphometic Study Of Suprascapular Notch In Western Up"**, **MANISHA SCOTT** is informed that the **Dissertation Protocol** submitted by him/her was considered by the **Screening Committee** of the **Allied Health Sciences** in its meetings held on 07.02.2024 and 29.02.2024. The recommendations of the **Screening Committee** were considered in detail by the **Institutional Ethics Committee** in its meeting held on **15.05.2024** and the same was **approved** by the **Ethics Committee** of the **Santosh Deemed to be University, Ghaziabad, Delhi NCR**.

He /She is informed accordingly for further necessary action.

17/5/24

[Dr. EZHILRAJAN. K]
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STASTICIAN CERTIFICATE

This is to certify that the statical analysis component of the thesis titled **"Morphometric study in Suprascapular notch in western UP population"** done by **Manish Scott** in the Department of Anatomy Santosh Medical College and Hospital, Ghaziabad, has been conducted under my guidance and supervision.

All the statistical calculations of the study are authentic and correct to best of my knowledge.

Wish her all the success in her life.

Dr. Amod Kumar Chaudhary, PhD

Assistant professor cum statistician,

Department of community Medicine,

Santosh Deemed to be University, Ghaziabad,201009.

PLAGIARISM CERTIFICATE

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